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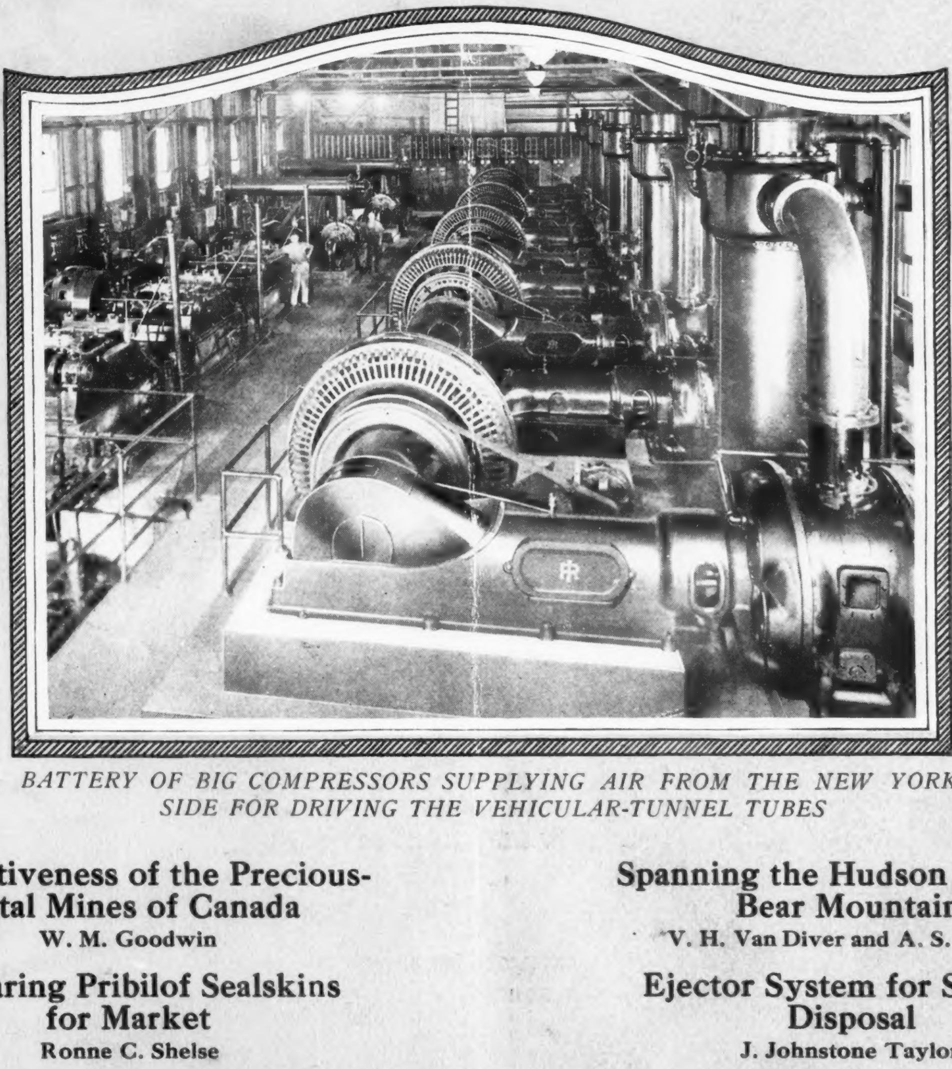

BATTERY OF BIG COMPRESSORS SUPPLYING AIR FROM THE NEW YORK SIDE FOR DRIVING THE VEHICULAR-TUNNEL TUBES

Productiveness of the Precious-Metal Mines of Canada
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VOL. XXIX, NO. II

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Productiveness of the Precious-Metal Mines of Canada

Survey of the Development, the Character, and the Output of the Deposits That Have Added Greatly to the Dominion's Wealth

By W. M. GOODWIN*

IN THIS day of intensified material progress, the march in the handling of metals is mainly emphasized by the tremendous tonnage of iron, steel, copper, aluminum, zinc, and the like that enters into all sorts of machines and engineering work. Comparatively little attention is given by the public to the volume and the value of the precious metals garnered from Mother Earth annually.

The extracting of these riches from the primordial rock can be done profitably only through the extensive use of compressed air and the employment of pneumatic tools especially designed to break their way into the hardest of geological barriers.

The story of Canada's contribution to the yearly production of precious metals would not be the absorbing and the very suggestive one it is were it not for the mechanical aids now at the disposal of both the prospector and the miner.

THE DOMINION of Canada is one of the world's great depositories of metals, particularly of precious metals. In 1922, its mines yielded one-eighth of the world's gold, worth $26,000,000, and one-tenth of the total silver, valued at $12,500,000. It has been slow in attaining this position; but, owing to its mineral wealth, Canada is likely to remain an important mining country for an indefinite period. The deposits have been difficult to find, inasmuch as they are often located in inaccessible regions in the midst of dense forests and are concealed, for the most part, by overburdens varying in thickness. There is every reason to believe, therefore, that other deposits will be discovered from time to time for many years to come.

Nowadays, "Hollinger" and "Premier" are names to conjure with. These two mines, whose surfaces have barely been scratched, are among the greatest gold and silver workings in the world. However, their combined output, worth over $18,000,000 in 1922, is but a small part of the country's total mineral production: numerous smaller mines, little heard of by the public, furnish the largest share of the output. Hence, in a necessarily abridged article on Canada's precious-metal mining, one can merely "hit the high spots"—describing only those mines that have become famous in the annals of the Dominion and those that promise to be added to the list of big producers.

The first precious-metal mining in Canada is attributed to the "forty-niners" of California. Some of those pioneers, always going further afield, found gold in the Fraser River, British Columbia, in 1858. They were but moderately rewarded until 1860, when they discovered the wonderfully rich placer deposits of the Cariboo district. Though this region was 300 miles away from the base of supplies on the Pacific coast, a transportation system by water and by land was organized; and during the next decade $30,000,000 worth of gold was washed from the gravel. In the meantime, the prospectors pushed farther and still farther north, opening up the Omenica and then the Cassiar placers. Later on, hydraulicking succeeded mining by hand; and now it is proposed to install dredges to clean up the gravel benches abandoned by the old-time miners. It is interesting to note in passing that the small annual production still maintained at these placers was augmented in 1922 by new and rich deposits found at Cedar Creek, in the Cariboo district, high above the level at which they were supposed to exist.

The second great gold rush in Canada began in 1894, when the Klondike in the Yukon was discovered. For years, miners had been working the streams in the territory with but little success. The spectacular find of the pioneers along Bonanza Creek caused the historic rush of 1897-1898, which is well within the memory of the present generation. In 1900, the production of gold reached a value of $22,000,000; but gradually the output declined, and today the placers in the Yukon yield about $1,000,000 a year—the mineral being won by hydraulicking and dredging.

When the prospectors found that their dreams of wealth from placer gold were dispelled, they turned their attention gradually to the less attractive hard-rock deposits. To work these required machinery, power, and supplies, as well as railways. Efforts, commenced in 1862, to mine the rich but irregular "saddle reefs" of gold quartz in Nova Scotia were carried on unsuccessfully for 25 years. The gold booms in the Rainy River district and the Lake of the Woods, both in the northwestern part of Ontario, likewise failed to produce good results.

Lode-mining operations of importance were first conducted in British Columbia, and were begun there in 1887. During the succeeding decade, the copper-gold-silver mines of the Nelson, the Rossland, and the Boundary districts, as well as the silver-lead deposits of the Slocan and the East and the West Kootenays were located, operations were started, and shipments of ore were made. All these districts, with the exception of the Boundary, are still active. As old deposits have become exhausted, others have been discovered. The famous St. Eugene mine, found in 1895, yielded its rich silver-lead ore steadily for twenty years. When it was finally worked out, the reputation of East Kootenay might have suffered had it not been for another deposit a little to the north, the Sullivan mine, which has already far exceeded the record of its predecessor. At the present time, the Sullivan mine, which will be described later, not only

*Editor, The Canadian Mining Journal.

provides Canada with most of her zinc but it also produces much of that metal for export. In the Boundary district, just referred to, two copper-gold smelters flourished for many years until the ore became exhausted. One of the concerns that used to operate there, the Granby Company, has recently renewed its youth in another locality and now has a mine and a smelter at Anyox, on the Pacific coast, that far surpass the original plant in size.

Many of the engineers in charge of Canadian mines today began their professional careers at Rossland. Twenty years ago, miners' wages at the Centre Star, War Eagle, and Le Roi workings helped to put numerous budding mining engineers through college. Though the richest of the gold-copper from those sources was exhausted some years back, the self-fluxing nature of the rock in which it is found makes it possible to utilize a low grade of ore. More recently, the flotation process permits the separation of the sulphides from the rock; and, in consequence, the camp has taken on a new lease of life. Vast reserves of low-grade ore are available for this treatment; and once more the region will be supplying ore to the copper smelter at Trail, close by.

A large silver nugget from the Cobalt district.

Incidentally, the boom at Rossland 30 years ago marked the beginning of Canada's mining machinery trade: a number of enterprising manufacturers in the East took advantage of the opportunity and commenced to build hoists, compressors, rock drills, pumps, etc., and from that day to this the Dominion has remained virtually self-sufficient in these lines of industry.

We started out to tell about the precious-metal mines of Canada, but, judging by the foregoing, we would appear to have taken up the subject of copper, lead, and zinc. However, in British Columbia, the precious metals are almost invariably associated with the baser metals, and the smelters that turn out the refined lead, zinc, and copper from the province also produce its silver and its gold. There are today two great smelters in British Columbia, that of the Consolidated Mining, Smelting & Power Company at Trail, in the southern central part of the province not far from the international boundary, and that of the Granby Company at Anyox on Observatory Inlet at the southernmost part of the Alaskan coast. With the exception of the new and fabulously rich Premier mine, all the great precious-metal mines of the province, and most of the small ones, ship their ore to these two smelters. The plant at Anyox produces blister copper containing gold and silver, while the one at Trail turns out precious metals and electrolytically refined copper, lead, and zinc.

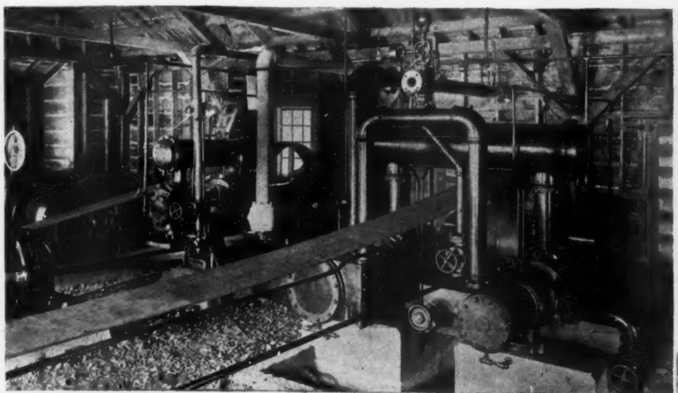
The smelter at Anyox was built there because nearby, in the Hidden Creek mines, are vast deposits of copper ore carrying gold and a little silver. They are the largest known copper deposits in British Columbia, and are at present furnishing metal at the rate of 3,000,000 pounds a month. The latest official estimate shows a reserve of over 10,500,000 tons of ore—9,000,000 tons averaging about 2 per cent. copper, and 1,500,000 tons 1 per cent. copper. This reserve will last for thirteen years at the present rate of production. Underground mining is practiced; and the cost of ore delivered at the smelter is less than $1 a ton. The precious metals are shipped abroad, in the shape of blister copper, for separation and refining.

The principal source of ore supply for the Trail smelter is the Sullivan mine, where there is known to exist an unusually large deposit of sulphides with good values in zinc, lead, and silver in a pyrrhotite gangue. All efforts to separate these intimately mixed sulphides for commercial purposes were, however, fruitless until recently, when a method of differential flotation was worked out by the metallurgists at Trail. This discovery has provided a key that will open up the largest zinc deposits in the world. Not long ago, a new concentrator, with a capacity of 2,000 to 3,000 tons of ore a day, was put into action at the mine. This ore contains about 13 per cent. zinc, 11 per cent. lead, and 3 ounces of silver per ton. After fine grinding, almost all these values are recovered in the form of remarkably clean lead and zinc concentrates.

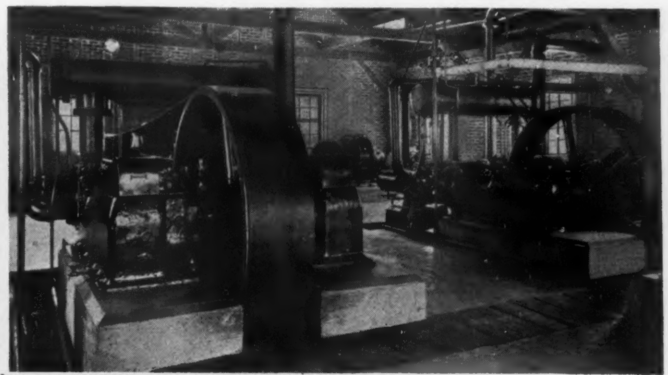
A considerable share of the ore smelted at Trail is bought from independent mine operators. There are numerous smaller silver-lead and silver-zinc mines in the locality that thus find a profitable outlet for their ore, as there is maintained a fair schedule of smelting rates. The Consolidated Mining, Smelting & Power Company apparently believes in encouraging these operators, especially as one of the lesser deposits may at any time turn out to be a large one, such as the Sullivan which, alone, can provide zinc enough to supply a large nation.

Smelters and refineries of the Consolidated Mining, Smelting & Power Company at Trail, B. C. Here are treated substantially all the copper-gold, silver-lead, and lead-zinc-silver ores of central and eastern British Columbia.

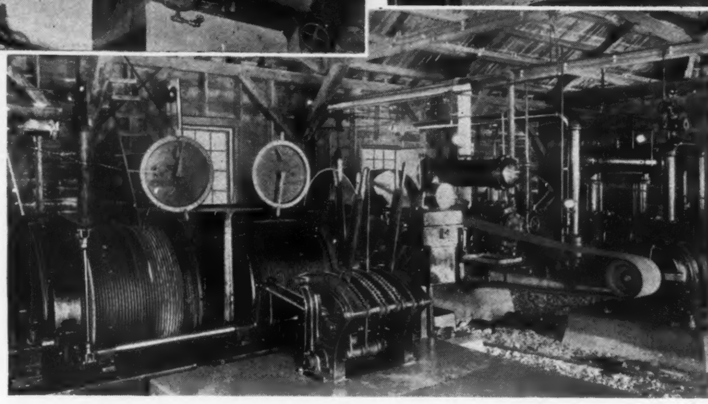
The newest, as well as the most spectacular of the big mines of British Columbia, is the Premier, which is situated in the northernmost part of the province on the Pacific coast. The ore is galena, with high values in both gold and silver. In their last annual report, the management announced that there is left a comparatively limited amount of this high-grade ore, as it is due to secondary enrichment within a few hundred feet of the sur-



Straight-line and duplex, belt-driven compressors at the Sylvanite gold mines of northern Ontario.



Other Ingersoll-Rand combined steam and motor-driven compressors at the Wright-Hargreaves mines.



Double-drum, single-reduction, electric hoist at one of the Sylvanite gold mines. The builders of this hoist, the Canadian Ingersoll-Rand Company, Limited, have long specialized in this type of mining machinery.

face. However, there does exist a quantity of primary ore of a lower but still very satisfactory grade that will make the mine outlast by many years its present bonanza days. The veins of the Premier have an average width of 15 feet; and the ore shoots are several hundred feet in length. More than a year ago, there was in the stopes a matter of 73,000 tons of broken ore, valued at $35 a ton; 300,000 tons of high-grade ore was developed and estimated, while milling ore constituted a much larger amount. The mine is equipped with a concentrating and cyaniding mill of 4,000 tons monthly capacity, but a new and larger mill is contemplated. The ground is opened from adits. An 11-mile aerial tramway connects the mine with tidewater at Stewart, on the Portland Canal, whence the ore is shipped to smelters at Anyox, B. C., and Tacoma, Wash.

While in the West, let us take a glance at the Yukon's new lode mines on Keno Hill, near Mayo, 75 miles southeast of Dawson City—the capital and one-time popular placer-mining center. About three years ago a vein of galena, carrying 200 ounces and more of silver to the ton, was discovered at this point, and a small lot of this rich ore was carried over the snows to Stewart River, and thence down the Yukon to its mouth. More veins were found; the transportation system has since been improved upon by the use of tractors over the snow-piled roads; and in the winter of 1922 approximately 9,000 tons of ore, worth about $1,500,000, was shipped out. A good deal of low-grade ore, not rich enough to pay for the expense of the long and difficult haul to market, has been uncovered; and, from all indications, Keno Hill and its environs may become a steady producer.

For precious-metal mining, pure and simple, the Province of Ontario holds the palm. All its successful gold and silver mines have been found and developed within the last twenty years; and most of them are located in three camps—at Cobalt, including South Lorrain eighteen miles distant, at Porcupine, and at Kirkland Lake. The products from these mines and from the Sudbury nickel workings represent substantially the total metal output of the province. The only precious minerals in the Sudbury ore are the platinum-palladium group that yields Canada's small annual contribution of these rare metals.

Ontario was put on her feet in the matter of precious-metal mining in 1903, when a little vein—three or four inches wide—containing native silver was discovered in a railway cutting at Cobalt. Since then the province has outstripped her western rival, British Columbia, and promises to keep in the lead. A systematic search in the Cobalt camp has revealed hundreds of these small veins within an area of some five square miles; and, up to date, they have furnished over $200,000,000 worth of silver. Production is waning—that of 1922 amounting to only $5,000,000. But during the last few years, geological studies have aided much in following up old veins and in discovering new ones; and some recent developments have opened up a new area for prospecting along the deep-buried underside of the intrusive sill of diabase rock, whose advent brought silver.

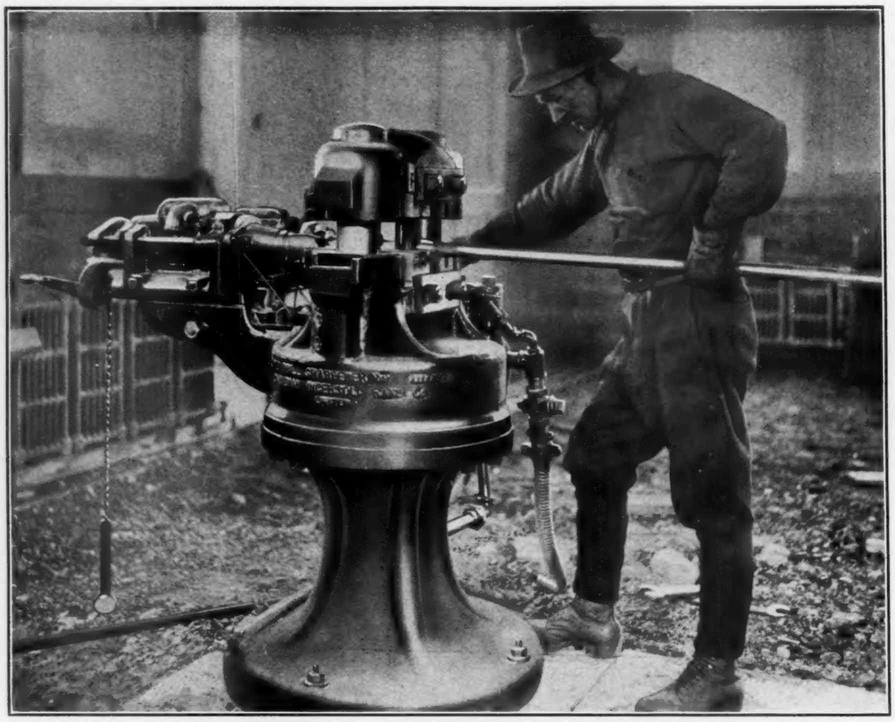
In the meantime, Cobalt has exploited another rich silver-producing region. Last year, there were discovered some wonderfully rich ore shoots in South Lorrain mines that had been partially developed and then abandoned in the early days of Cobalt. These comprise an area of not over 100 acres, and are now producing silver at the rate of 2,500,000 ounces per annum.

Outcropping at the famous Hollinger mine as it appeared thirteen years ago. This property has produced to date more than $65,000,000 worth of gold, and the larger part of the workings has not yet penetrated below the 1,000-foot level.

The largest of the Cobalt producers are the Nipissing mines. The original owners were fortunate in acquiring from the men who staked the claims almost one-quarter of the silver-bearing area in the heart of the camp. Over 60,000,000 ounces, or substantially one-third of the entire Cobalt silver output to date, has come from this property. It is still the biggest producer, and its output is likely to continue to be large for many years to come. Shareholders have received over $25,000,000. The veins are small; are scattered throughout the property; and are worked from numerous small shafts. Characteristically, there is an inch or two of high-grade ore in calcite gangue, with milling ore of much

lower grade for a foot or so on either side. A very effective wet metallurgical treatment has been worked out by the staff, with cyanide as the principal reagent.

The richest part of the Cobalt camp is the area owned by Coniagas (Co for cobalt; ni for nickel; ag for silver; and as for arsenic.) From this claim of 40 acres there has been taken over 30,000,000 ounces of silver; and it has paid more than $12,000,000 in dividends. Its veins are numerous, and the milling rock on their margins is unusually wide and rich in values. The milling process, also developed on the spot to suit the ore, yields concentrates; and these are treated in a smelter and a refinery, at Thorold, Ont., that were likewise developed by Canadian metallurgists. The most productive vein in the Cobalt camp was the "Carson" vein on the Kerr Lake property. This yielded 14,000,000 ounces of silver, all of which was above the 200-foot level. Its record is now threatened by the "Woods" vein, in South Lorrain, which so far has produced most of the silver of that district.



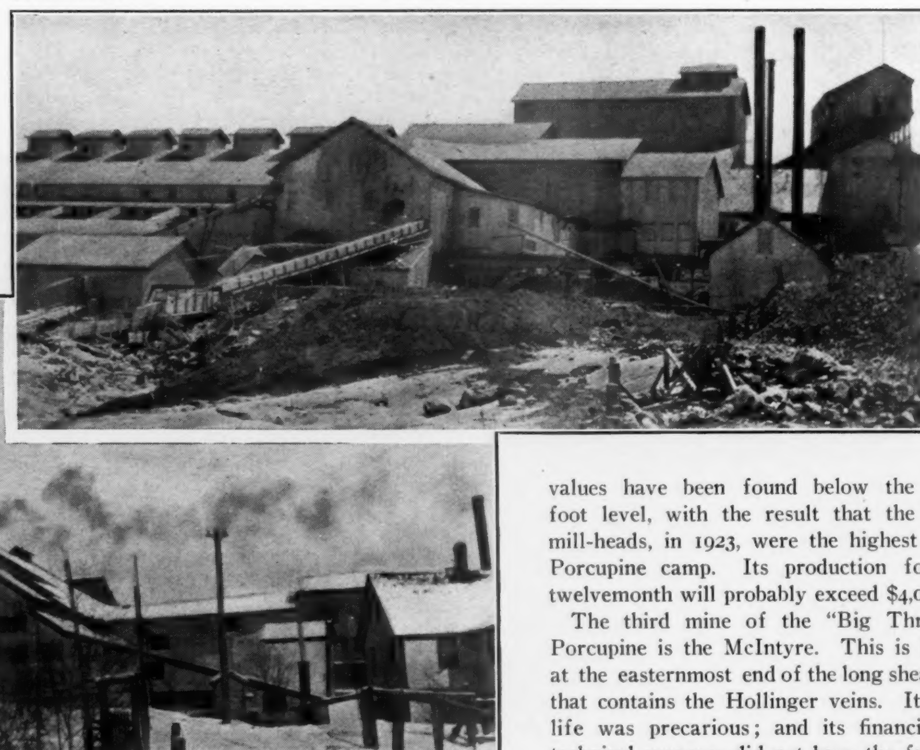
The drill sharpener has proved its worth in Canadian mines. This sharpener is part of the equipment of the Lake Shore mines in the Porcupine district.

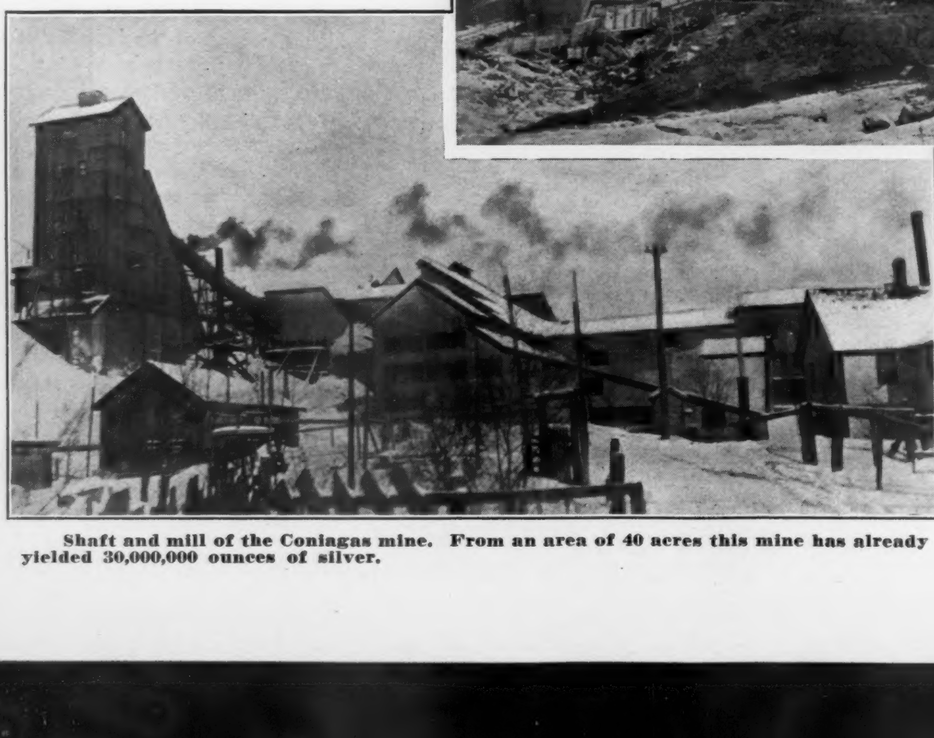
It was in 1909 that Ben Hollinger and his partner John S. Wilson, prospecting along an old Hudson Bay portage route between the Mattagami and Frederick House Rivers 150 miles north of Cobalt, staked the two groups of claims that now comprise the Hollinger and Dome mines in the Porcupine camp. Like the true sports they were, they tossed a coin to see which group each would take. Hollinger won the claims that now bear his name. After uncovering a promising showing of gold quartz, Hollinger optioned the property to a syndicate that had made a fortune in the Cobalt camp by working and then selling the La Rose mine.

For over a year it seemed doubtful whether the deposits would result in a mine. In 1911, moderate success was achieved; and from that time on Hollinger's rise has been rapid. To date, the property has produced over $65,000,000 in gold, and yet the larger part of its 25 miles and more of workings is still above the 1,000-foot level. Boreholes have shown that the gold-bearing formation continues unchanged down to a depth of at least 3,000 feet. It has been calculated that the mine will produce $450,000,000 worth of gold if the volume and the value of the ore persist as at present to a depth of 5,000 feet; and there is every reason to believe that it will do so.

To Wilson, the toss of the coin gave the Dome claims. A little stripping, on a dome of white quartz, disclosed the marvelous showing of gold that became known as the "golden stairway." It corresponded to the "silver sidewalk" that had been uncovered a few years before at the Kerr Lake mine in Cobalt. By reason of this outcrop, Wilson sold his claims to a group of nickel-copper magnates. The dome, however, did not live up to the promise of the outcrop, under which a huge glory hole had been opened up. Values decreased, and selective mining had to be adopted. Within the last two years, however, much higher values have been found below the 1,000-foot level, with the result that the Dome mill-heads, in 1923, were the highest in the Porcupine camp. Its production for that twelvemonth will probably exceed $4,000,000.

Ore-reduction plant of the Nipissing mines. The mills handle both high and low-grade ores.





Shaft and mill of the Coniagas mine. From an area of 40 acres this mine has already yielded 30,000,000 ounces of silver.

The third mine of the "Big Three" at Porcupine is the McIntyre. This is located at the easternmost end of the long shear zone that contains the Hollinger veins. Its early life was precarious; and its financial and technical sponsors did not have the full confidence of the mining fraternity. Then a new management was installed; the mine was developed in a business-like way; plenty of

ore was uncovered; and today the property promises to run the Hollinger a close second for the world's championship as a gold mine. It is the deepest gold mine in Ontario, having reached a depth of 2,500 feet; and its output in 1922 was valued at more than $2,000,000.

Kirkland Lake, 55 miles to the southeast of Porcupine, is the oldest and, at present, the only productive portion of a gold belt that extends east and west for a distance of 150 miles from Matachewan in Ontario to Bell River in Quebec. The ore shoots at Kirkland are found almost exclusively in a "main break;" and along its course, for a distance of three miles, there are no fewer than six separate mines and mills. Five of these—Kirkland Lake, Teck-Hughes, Wright-Hargreaves, Lake Shore, and Tough-Oakes—are successfully operating today.

Sinking a shaft in a silver mine with "Jackhamers."

The ore from the Kirkland Lake property is not difficult to treat, and its mills are models of perfection. To a visitor, they appear to be well-nigh automatic in their operation. The Wright-Hargreaves 200-ton mill, in particular, is notable, as it requires the attendance of only a couple of men on each shift. In 1922, the five mills turned out over $2,000,000 in bullion.

In conclusion, mention should be made of the future of Quebec's new gold field, the Lake Fortune property situated ten miles east of the Ontario boundary and lying within the gold belt that includes the Kirkland camp. There a shear zone, much like the formation that carries the gold at Porcupine, has been found to bear excellent values throughout satisfactory widths and lengths. Twelve miles further to the east, on the property of the Noranda mines in Rouyn township, an even more encouraging surface showing has recently been opened up. These two finds will serve to stimulate a thorough exploration of the district; and from all indications it seems certain that Quebec will be in a position in a few years to add substantially to the production of gold from Ontario and British Columbia—now Canada's chief sources of precious metals.

GALVANNEALING

THE rough-and-ready process of coating iron articles with zinc, misleadingly called galvanizing, has never commanded the respect of the industrial world for the reason that the results produced have not been altogether satisfactory. A new method, named galvannealing, for which great things are claimed, has been developed by the Keystone Steel & Wire Company, Peoria, Ill.

The article, after leaving the bath of molten zinc, is passed immediately without wiping into a heat-treating furnace — the heat treatment smoothing the coating and making it flexible and malleable. The process, as applied to wire, is continuous: the wire being in the heat-treating furnace only a few seconds. Thousands of tons of wire, principally for fencing, are now produced in this way.

Stainless steel has proved itself to be the greatest advance in metallurgy since the discovery of high-speed steel, and rapid progress is being made in its development and its application, especially at Sheffield. It is being used more and more for general engineering purposes; and has been adopted by practically all the turbine manufacturers in England and on the Continent for turbine blades. Probably three-quarters of the cutlery now manufactured in England is made of this material.

At left—"Leyner" drill at work on a heading in a gold mine. At right—The "Jackhamer" has proved very effective for stoping in precious-metal mines.

MODERN WAR WEAPON FINDS STRANGE VICTIMS

SPECTACULAR methods not much different from those used in the World War were employed by scientists in the California State Department of Agriculture to eradicate an army of white snails—a European pest that threatened the destruction of citrus orchards near San Diego. After trying various poisons without much success, the entomologists turned a "flamer" on the millions of snails which had established headquarters in a canyon at La Jolla.

The flame thrower consists of a power sprayer, to which are attached two long lines of hose provided with 16-foot spray rods. At the ends of the rods are nozzles that produce a fine mist.

Courtesy, California State Dept. of Agriculture.

Fig. 1—Cluster of white snails.
Fig. 2—Part of the infested area.
Fig. 3—Close-up of flame thrower in action.

Stove distillate is used as fuel; and the spray, when set on fire, makes a roaring flame that consumes everything in its path as it is played over the ground. In extending the eradication campaign to areas less accessible than the canyon, the power outfit was replaced by smaller flamers operated by hand.

Before the eradication of the snails was attempted, the pests had clustered in enormous numbers on plants and shrubs. In fact, they were practically everywhere—they crawled on houses, telephone poles, under stones, into cracks in bridges and fences, and even under buildings. The canyon, where the snails first entrenched themselves, is a wild, rocky gorge running from the sea back through a portion of La Jolla; and from there the army spread out over adjoining property.

The attack against the mollusks was launched by a force of ten men, equipped with heavy hoes, scythes, and axes. The canyon was completely denuded of vegetation; and this work was followed a few days later by the flame thrower. The habits of the pests and the conditions encountered were such as to make it imposible to get rid of every snail in going over the ground the first time; but, by persistent hand picking and poisoning subsequently, the numbers were so reduced that the eradication of the white snails seems to be assured.

How these mollusks became established in southern California is somewhat of a mystery. They may have been introduced as a foodstuff by immigrants from Sicily; they may have escaped from a collector's specimens; or they may have been brought into the country accidentally with shipments of plants or other imports. Be that as it may, the presence of the pests was noticed as early as 1914, but they did not become a menace until 1919. The final campaign, however, that led to their successful obliteration was not begun until more than three years later.

An outfit similar to the one employed at La Jolla was utilized recently to destroy an army of grasshoppers on the Government's irrigation project in northern California and southern Oregon. Compressed air was used to operate the spray. Manager Newell, of the Klamath project, described the portable plant in his official report as follows:

"The arrangement consists of a small truck or wagon on which is mounted a small air compressor, gasoline driven; an air tank, which in this case is an ordinary hot-water tank such as would be used with a kitchen stove; and a barrel of gasoline. By means of piping, the air and gasoline are delivered to two flattened nozzles through about 40 feet of ⅝ or ¾-inch rubber garden hose. By this contrivance, a spray of gasoline and air is forced from the end of the flattened nozzles. This is lighted, and the result is a sheet of fire with which the operator can 'mop' the ground or spray it exactly as he would a garden. The air compressor is of sufficient power for a third line of hose; and, with this equipment, a zone 80 feet wide can be covered."

The grasshoppers usually move in ranks having a front anywhere of from 100 yards to a quarter of a mile and a depth of from 50 to 100 feet. The flame thrower is directed at them, when they are well bunched, with great destructive effect. This inexpensive outfit was largely contrived by a homesteader on the Klamath project.

Spanning the Hudson River at Bear Mountain

This Notable Engineering Undertaking Will Link the East and the West Shores of this Beautiful Stream Where it Will Prove a Great Boon to Automobilists

By V. H. VANDIVER and A. S. TAYLOR

THE RAPID increase of traffic by boat across the Hudson during the last ten years has emphasized the shortcomings of the ferries which are now counted upon to handle this vehicular tide. Accordingly, business enterprise has set out to remedy the situation by constructing a suspension bridge of splendid proportions.

Though the building of this bridge and the construction of its approaches present a number of outstanding difficulties, still the engineers have tackled their job undaunted, and the work is now well under way.

The advance that has been made up to date in carrying out this monumental project is in no small part due to the help rendered by portable compressors which furnish operative air to pneumatic tools working at comparatively inaccessible points in clearing away great masses of rock.

THE CLOSE geographic and economic relations existing between populous New England and the Middle Atlantic States focus attention upon the need of unretarded means of intercourse so that the two sections can develop to their mutual benefit. South of Albany, transportation across the Hudson River—as far as vehicular traffic is concerned —has hitherto been made possible only by lines of ferries.

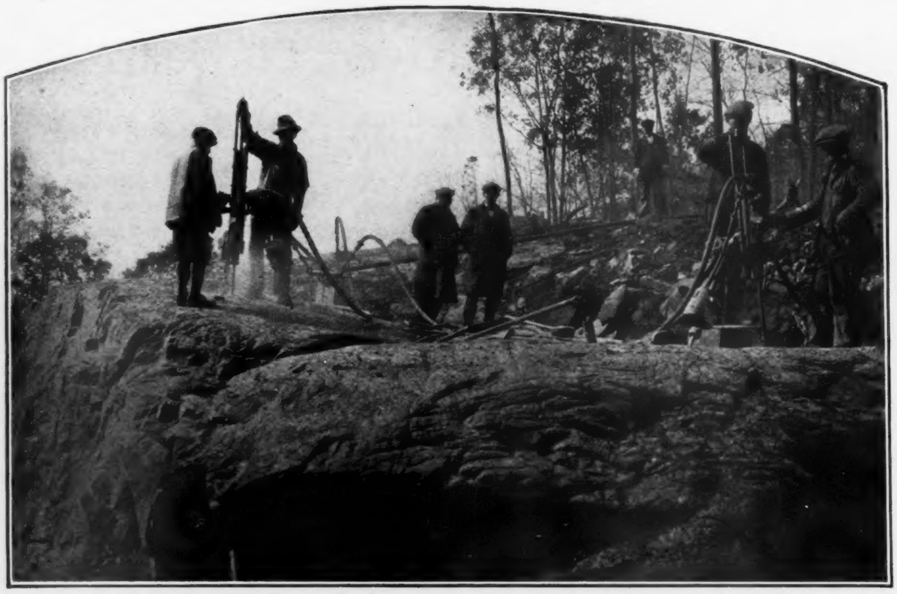
The ever-expanding growth of motor traffic and the extension of the system of good roads have, conjointly, brought about a condition which has laid a heavy and a disproportionate demand upon existing cross-river service, and the ferries are frequently unable to cope with the situation, especially on Sundays when passenger cars crowd the highways in great numbers. It is not necessary to elaborate upon the discomforts of the motorist when forced to stand in line for hours awaiting his turn to get aboard a boat and to be off again on his journey: the experience is a familiar one. This state of affairs is in no wise a reflection on the ferries as such; but the march of progress emphasizes the need of some form of relief which will enable the self-propelled vehicle to go hastening onward over waterways instead of halting at river banks for the coming and the going of vessels which move intermittently and which may be seriously interfered with by fog, snow, or ice.

Because of the acknowledged need of a bridge across the Hudson at some point within easy reach of the Metropolitan district, an exhaustive examination was made of all promising bridge sites lying between New York City and Poughkeepsie. As a result of the information so gathered, after due study of the relative merits of each, it was finally decided to place the proposed structure a few miles north of Peekskill, where the river flows between Bear Mountain on the west and Anthony's nose on the east. It was ascertained that a highway suspension bridge—insuring sufficient clearance for ships with towering masts—and the incidental approaches could be built there in less than two years at a cost of $4,500,000. The site is about 40 miles from the heart of New York City; and the span when finished will join the main highway, on the west, leading through Middletown, Binghamton, Syracuse, Elmira, Rochester, and Buffalo, with the Albany Post Road on the east side of the Hudson River. A charter for the bridge was secured by the Terry & Tench Company, Inc., who organized the Bear Mountain Hudson River Bridge Company, the builders of the structure.

For those who are familiar with the Hudson and the beautiful mountain ranges that rise from its shores, no description of the location of the bridge is necessary, but for those others, who have not been on this famous river, a brief account will enhance their appreciation of the project. On nearing the site from the south, by river, the observer will be perplexed at seeing ahead what appears to be an abrupt

How the Bear Mountain-Hudson River Bridge will look when finished.

ending of the stream. Across the channel, so it appears, stands a line of forest-clad hills known as the Manitou Range. As one approaches, however, a passage is disclosed through which the river flows. Turning this bend, Bear Mountain, which is 1,314 feet high, is seen ahead on the west. To the east, a peak 900 feet in height, known as Anthony's Nose, rises abruptly from the water and faces Bear Mountain on the opposite shore. The river is rather narrow where it runs between these flanking sentinels. At the foot of Bear Mountain lies a plateau about 150 feet above the river; and on this is located the Bear Mountain section of Palisades Interstate Park—a public playground of note.



Where heavier masses of rock have been encountered in the approaches to the bridge it has been necessary to drill 28-foot holes to facilitate blasting.

Up the river just north of the playground are two cliffs, and on their summits lie what remains of old Forts Clinton and Montgomery. This spot was, in the days of the Revolution, the Gibraltar of the Hudson River. It was from Anthony's Nose to Fort Clinton, on the west bank, that Washington's forces stretched an 1,800-foot chain and boom to prevent the British fleet from passing. Just 100 feet north of this historic spot is where the Bear Mountain-Hudson River Bridge will soon stand as a monument to the progress of a nation and to engineering ingenuity.

When the project is finished, the tourist may have an unobstructed ride, the scenic beauty of which is unsurpassed in the East. He may drive up one side of the Hudson and down the other, as has been his wont, without a long wait for a ferry. He may seek out the historic sites of those famous forts of the Revolution—Clinton, Montgomery, Independence, Constitution—and, while viewing their decaying ramparts, he may experience the thrill of treading on hallowed ground.

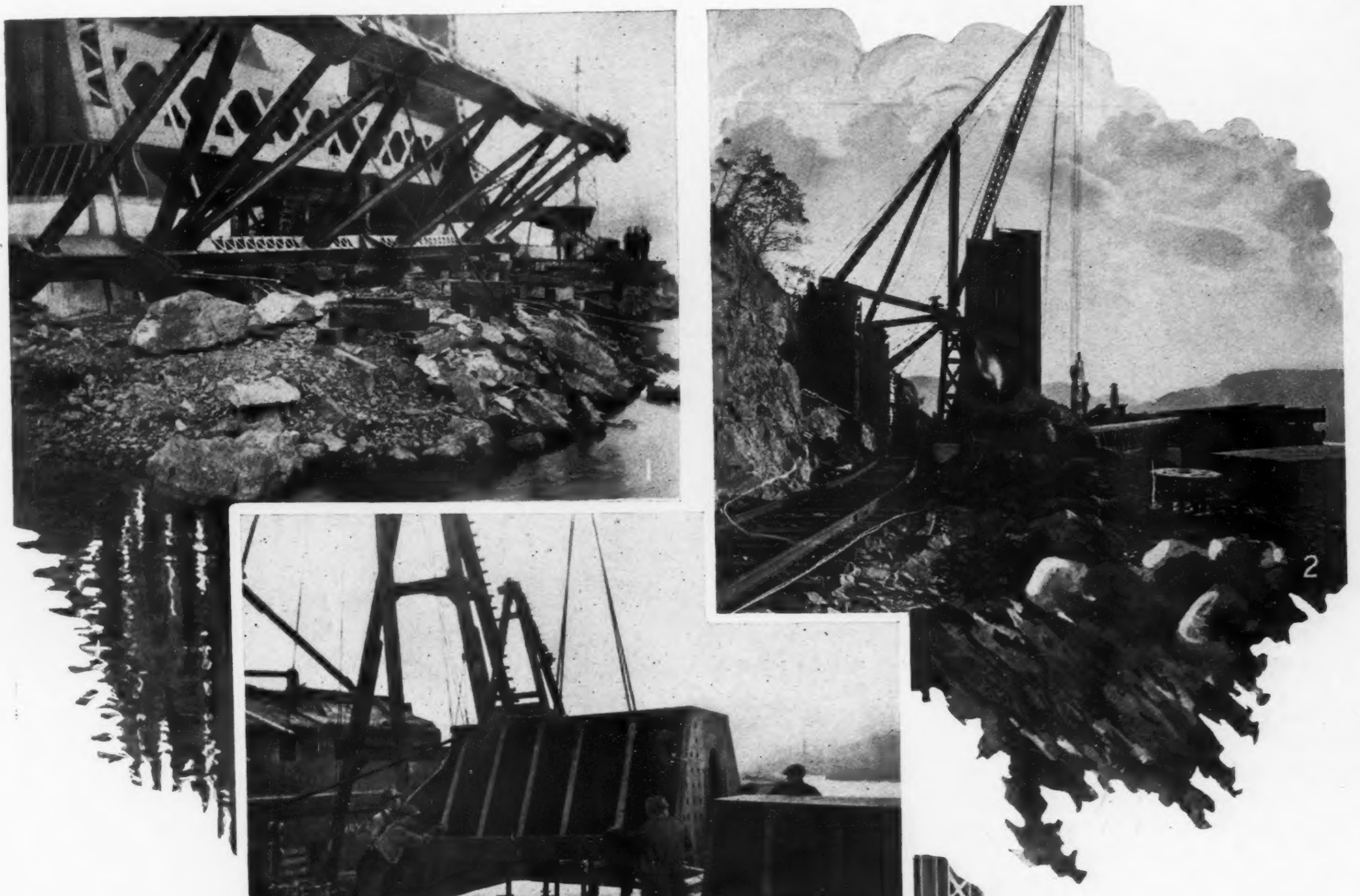
Thus far we have considered only the location and the surroundings of the undertaking. Now let us take into account the structure, itself. The bridge, which is estimated to cost $3,500,000, will consist of six sections of structural steel, as follows: the main span, 1,632 feet between the centers of the main towers; the east-shore span, 210 feet in length; and the west-shore span, consisting of four sections 410 feet long.

Two big steel wire cables, 18 inches in diameter, will carry the main span, which will have a clearance of 153 feet above the river at mean high water. The cables will be attached to solid anchorages at each end and will be supported by two towers, each 355 feet in height measured from the top of the piers. A single roadway, 38 feet wide and to be made up of asphalt blocks laid on a concrete base, and two 5-foot sidewalks will accommodate vehicular traffic and pedestrians. The main floor of the bridge is to be carried by 2¼-inch wire-rope suspenders hanging pendant from the main cables and spaced at intervals of 25½ feet. At their lower ends, the suspenders will be attached to transverse floor-beam trusses; and interposed longitudinal stringers, fashioned of steel plate, will tie the trusses to one another. The floor structure will be further stiffened by a great lengthwise truss on each side. Each of these trusses will have a depth of 30 feet, and they will parallel each other and be placed 55 feet apart, from center to center. There is every reason to believe that the floor will have ample strength to meet the maximum requirements of service with a generous factor of safety.

Each of the towers will be composed in the main of two structural steel posts bound together by an interconnecting framework of heavy steel plates and angles. And each post, in its turn, is formed by two double-box outer sections which are united by a thick diaphragm of steel plate supplemented by two lines of steel latticework. The posts have a maximum spread, parallel with the axis of the bridge, of 30 feet at the base, and this dimension tapers gradually to 11 feet at the top. In cross

Sharpening steels for "Jackhamers" and "Leyner" drills at work in anchorage shaft on east side of river.

A small "Leyner" sharpener, No. 33, making 1-inch steels used in drilling on road of east approach.



Photos. by T. Jargstorf.

Fig. 1—About to hoist one of the stiffening trusses into place on the west tower. Fig. 2—Making progress on the east tower. Fig. 3—Lowering a big cast-steel shoe into position on one of the west-tower piers. Fig. 4—Another view of the assembling of the east tower. Fig. 5—Details of some of the features of the west tower.

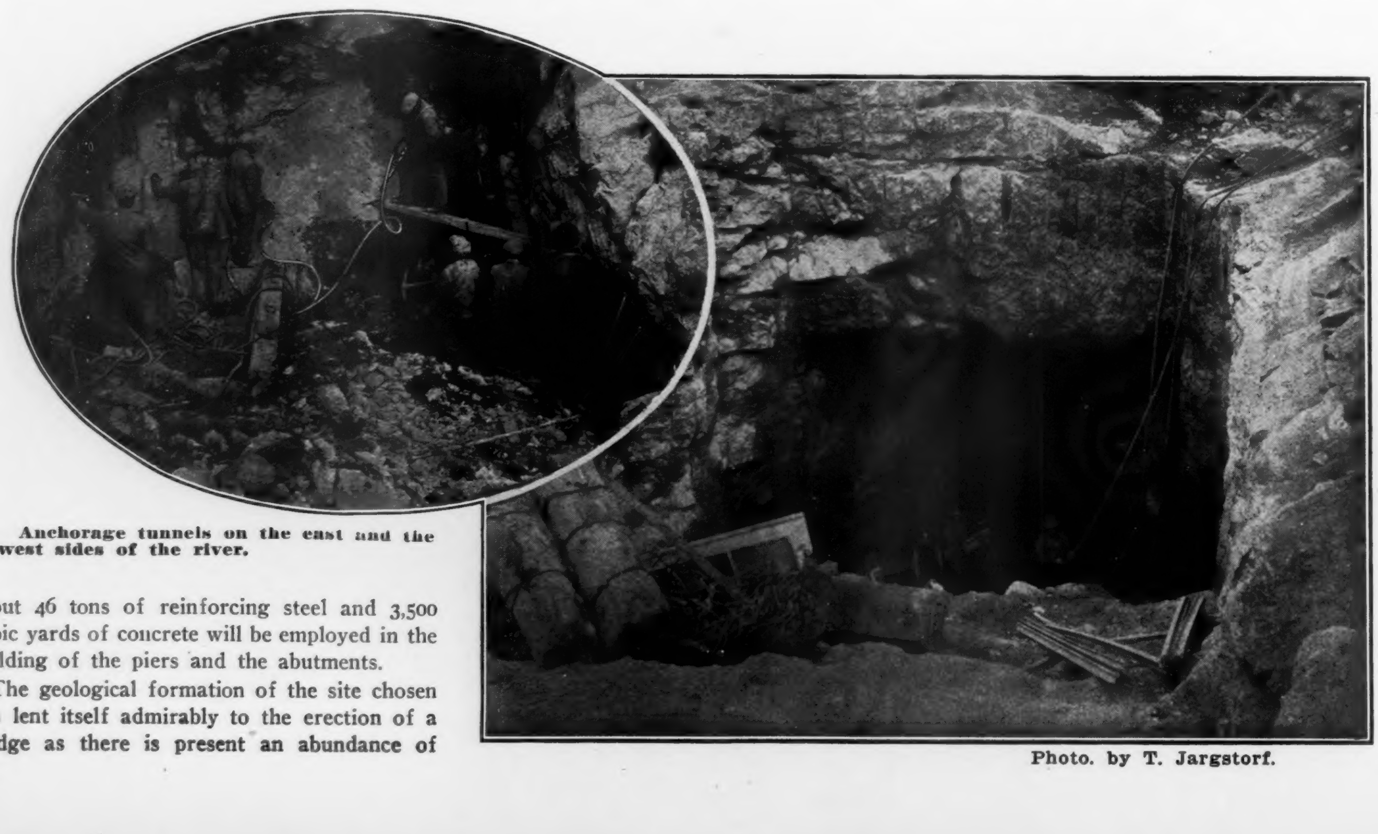
"Jackhamers" are doing fine work in drilling 20-foot holes in the rock for the road approach on the east side of the Hudson.

section, the posts have a uniform width of 6½ feet throughout.

Possibly a still better conception of the magnitude of the bridge can be had from the following outstanding particulars: The main span will have in its get-up a matter of 4,000 tons of structural steel; the shore spans will be composed of 1,000 tons of steel; 4,100 tons of plates and angles will be worked into the towers; 7,250 miles of No. 6 galvanized wire, weighing 2,000 tons, will be used to fabricate the main cables, and an additional 50 tons will be utilized in producing the suspenders; and about 46 tons of reinforcing steel and 3,500 cubic yards of concrete will be employed in the building of the piers and the abutments.

The geological formation of the site chosen has lent itself admirably to the erection of a bridge as there is present an abundance of solid rock to carry the footings of the piers and the abutment foundations. But, in order to prepare the way for these structural features, it has been necessary to do much drilling, blasting, and mucking. The incidental drilling has been done by an array of DCR-23 "Jackhamers." With the foundation work completed the erection of the bridge has been taken in hand; and this part of the undertaking will go steadily forward throughout the winter months.

The anchors for the main cables are of unusual design. It is said that they are the first suspension-bridge anchors to be placed in a nearly horizontal position; and they are to lie in line with the ends of the cables—that is, only 26 degrees from the horizontal. The anchors will be set in four tunnels that penetrate solid rock and, with one exception, reach into the rock for a distance of 80 feet—the exception being the southeast tunnel which is 50 feet long. In cross section, the tunnels are 11 feet square for most of their length, but at their innermost ends they flare out at an angle of 45 degrees and attain a width of 22 feet. The purpose of this is to accommo-



Anchorage tunnels on the east and the west sides of the river.

Photo. by T. Jargstorf.

Above—Pneumatic drills at work on the steep and sloping mountainside. At right—Portable compressors make it possible to operate drills in well-nigh inaccessible places.

will be of 7 per cent.; and the sharpest of the curves will be run on a 200-foot radius with a sweep of 29 degrees. All roadways, except where widened on curves, will be 18 feet broad and concrete surfaced. Curves of 1,000-foot radius and less will be

date the special castings which will key the anchorages in place and bind the moorings to the enveloping mountain walls. Eyebar chains will link the anchorage castings with the cables; and the tunnels will ultimately be filled with concrete.

Concrete roadway approaches, estimated to cost anywhere between $500,000 and $1,000,000, form no small part of the project. To build the roadways, which will have a total length of 3¼ miles, it will be necessary to excavate 108,000 cubic yards of material, 90 per cent. or more of which is rock; to fill in 107,000 cubic yards of material; and to construct 14,000 cubic yards of retaining wall. Were it possible to give the unfamiliar reader a knowledge of the topography of Anthony's nose—over which approximately 3 miles of the roadway approaches will lie—he would readily grasp the magnitude of the task involved and appreciate the seemingly staggering difficulties with which the road constructor has to contend in blazing a path along a precipitous mountainside. But in this day of labor-saving tools and equipment, the modern engineer is not easily daunted by cliffs and steep hillsides, such as are present in this case.

A group of portable compressors furnishes the needful operating air, in the least approachable places, for "Jackhamers," "Leyner" drills, and drill sharpeners; and these pneumatic tools are helping to transform Nature in her most rugged mood into an excellent foundation for a splendid highway.

The roadway approaches are built in accordance with the specifications of the New York State Highway Department. At its crest, the road on Anthony's Nose will be 410 feet above the surface of the river; the steepest grade

widened and banked in proportion to the radius, the greatest widening being 6 feet and the maximum super-elevation being at the rate of 1 inch per foot of width. The run-off for the widening and the super-elevation is made proportional to the radius; and for a 29-degree curve, for example, it is 85 feet.

Both the bridge and its approaches are owned by a private company; but the entire undertaking will revert to New York State at the end of 30 years, free of charge, or it can be purchased by the state at any time at a fixed price which is determined by the number of years it has been in operation. A small toll will be levied upon vehicles and pedestrians crossing the bridge.

Farmers and dairymen from the west shore of the Hudson, who dispose of their products in New York City, will be especially benefited because they can use the new route, which will take them quickly to their market, and thus avoid the accustomed and congested roads in northern New Jersey that are now the only available feeders to the ferries.

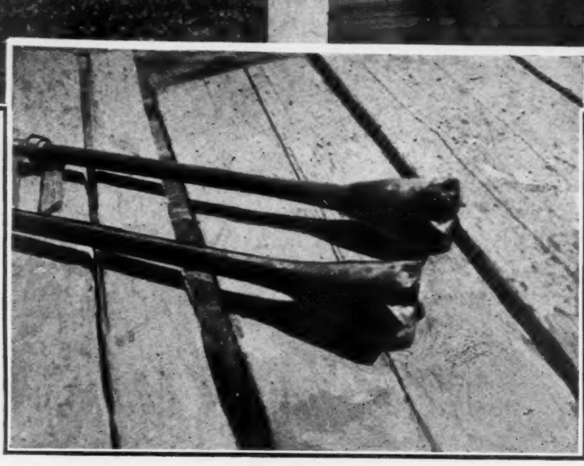
The offices of the Bear Mountain Hudson River Bridge Company are located at 39 Broadway, New York City.

Looking down the Hudson from Anthony's Nose.

"Jackhamer" Does Effective Under-Water Work in Restoring Damaged Jetty

Jetty after reconstruction. From the small arrow outward the jetty was destroyed.

The diver and others who played an important part in rebuilding the wrecked structure.



Type of bits devised to drill into the submerged, hard blue basalt.

SHELL HARBOR on the coast of New South Wales occupies a rather exposed position, and not long ago, during a period of violent whether, a jetty extending out from the shore was seriously damaged—in fact about 200 feet of its outer end was carried away by the driving seas. The pier is owned by the South Coast Road Metal Quarries, and from this pier the company ships its product. Therefore, it became essential to the activity of the quarries to reconstruct the jetty with the least practicable delay so that steamers could use it for loading.

The problem of rebuilding proved a difficult one, both because of the exposed situation and by reason of the underlying ocean bed that is there composed of hard, blue basalt to which the piles have to be securely pinned. This bond is effected by means of a 3½-inch steel pin projecting from the base of each pile and inserted into a hole drilled into the basalt ledge; and it was the drilling of these holes that occasioned most trouble in reconstructing the wrecked section of the pier.

It was suggested by the director of a prominent engineering concern that the holes be drilled by a "Jackhamer"—the tool being operated by a diver working on the sea bed. It was realized that this would be essentially an experimental undertaking, and it was therefore agreed that if the drill performed properly it would be purchased, otherwise no charge would be made. Blue basalt is very hard; and the nature of the rock made it problematical whether or not drills could be obtained which would be able to stand up to the work. It was proved during the preliminary stages of the undertaking that the machine could be counted upon to operate quite satisfactorily under water; and the next thing was to get suitable steels.

After some experimenting, success was won by adopting steels of the form shown in one of the accompanying illustrations. These steels carried 6-pointed rose bits which were worked up from 3½-inch steel billets and then welded onto standard drill shanks. The diver, Mr. John Farrugia, was able to drill 4-inch holes to a depth of 3 feet in 45 minutes, which was considered an excellent performance in view of the difficulties under which he labored in disturbed seas and at depths ranging from 17 to 30 feet. The use of the "Jackhamer" obviated the much higher expense which would have been entailed in rigging up a frame and employing a regulation submarine drill. The contractor for this job was Mr. Frank Oberton.

Following the effective application of the "Jackhamer" on the foregoing job, several chipping hammers were purchased by Messrs. W. Solomon & Sons, contractors in Sydney, for divers to use in cutting three or four inches from the sill of a large graving dock at Woolwich, Sydney. These tools have given the utmost satisfaction, and prove once more how certain types of air-driven equipment can be utilized to advantage under water.

The metal mines in New Mexico, in 1923, produced $550,000 in gold, 796,000 ounces of silver, 1,950 tons of lead, 33,600 tons of copper, and 8,150 tons of zinc, having a total gross value of $12,232,000. As compared with 1922, the output was more than doubled, inasmuch as the gold, silver, lead, copper, and zinc mined that year was worth but $5,898,446. In other words, the production of each metal showed an increase in quantity and an increase in gross value of over 100 per cent. over the preceding twelvemonth.

One of the noteworthy developments in Japan following the recent disaster is the large-scale introduction of modern labor-saving devices. The necessity for quick action and the shortage of labor are largely responsible for this move; and the speed and the efficiency with which up-to-date equipment cleared away the debris and are helping to rebuild the devastated sections have been revelations to the Japanese.

Mexico sets aside about 1,258,000 barrels of crude oil per week for domestic consumption.

A new method of preserving stone has been patented by an Edinburgh scientist, named Laurie. A silicic ether, diluted with a suitable volatile solvent, is applied to the stone; the solvent is evaporated; and the silicic ether is hydrolyzed so as to form hydrated silica, which fills the pores of the stone.

Nearly a century ago, in 1827, it took 284 blast furnaces to produce 690,000 tons of pig iron. At the present time, in the United States, this amount can be turned out by two furnaces.

Preparing for Market the Much-Prized Sealskins From the Pribilofs

By RONNE C. SHELSE

IN THE MIDDLE of the Bering Sea, more than 200 miles from any other land, are the Pribilof Islands, the summer home of a great seal herd from which the world gets its best fur coat. Every American should know the story of how his country came by these priceless possessions in the sea. Until 1867, Alaska and the islands thereabouts belonged to Russia. In that year the Czar, realizing that it was impossible to transplant his subjects to distant America, offered to sell the territory to the United States for $7,200,000. There was an awful furore: well-meaning statesmen and a part of the public press raised their voices in clamorous protest.

Already saddled with an enormous debt by the Civil War, the country should not be further burdened, they said, by pledging these millions for a tract of land "that we did not need, that nobody wanted, and that so far as known was utterly worthless." One member of Congress opposed to the purchase even proposed that Secretary Seward, who had conducted the preliminary negotiations for the treaty, should be reprimanded and "given to understand that the representatives of the people have other duties to perform than sanctioning such extravagance and folly."

WITH midwinter winds to be kept at bay, there should be timeliness in a story dealing with the source of the sealskin of commerce and what has to be done to make the raw fur fit for the garment dear to womankind.

Protracted diplomatic relations were necessary to protect the fur seal herds of Alaskan waters from extermination and to safeguard them so that the creatures would multiply. A census taken in 1922 indicated the presence of more than 600,000 of the animals in the so-called Pribilof herd.

During the fiscal year of 1923, at two sales in St. Louis, there was disposed of a total of 35,312 dressed, dyed, and machined skins which, with 201 raw skins, brought a matter of $1,100,279.80.

Thus the story of "Seward's folly" is written in the books of American history. Folly, indeed! The treaty was signed in the same year, and our country paid its debt to Russia. How paltry the purchase price when compared with the vast riches derived from the territory during the past 40 years. More than $500,000,000, or 70 times the sum we paid, has been earned from its mineral products alone, although the surface has merely been scratched. And what of the Pribilofs, the rookeries of the fur seal?

There are five islands in the Pribilof group but only the two larger ones—St. Paul and St. George, lying about 40 miles apart—are much frequented by these animals with the precious skins. Roughly speaking, the islands are 13 miles long and 6 miles wide; and their combined shore line of some 75 miles is composed of alternate stretches of sand and broken rock, backed here and there by steep cliffs. Inland the terrain is generally rough, but there are some long expanses of rather smooth ground covered with lichens and herbaceous plants. From early June until late August beautiful flowers grow in abundance. Ferns

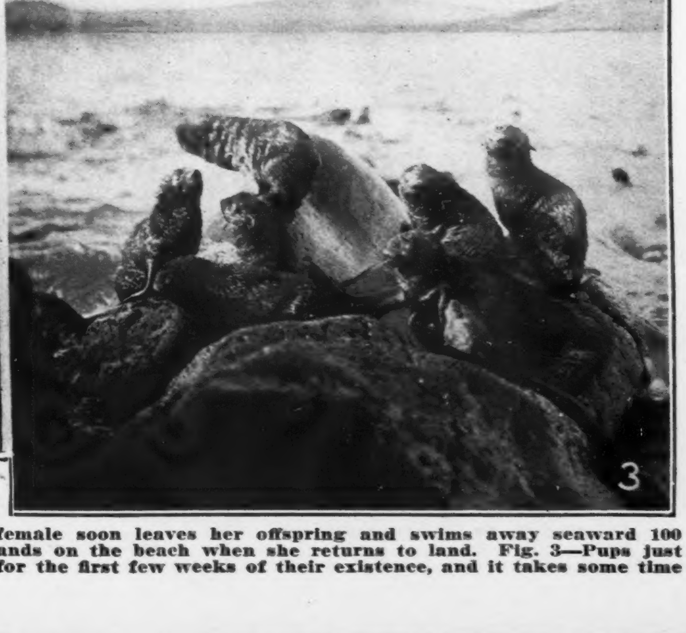


Fig. 1—Cutting off a pod of seals from the vast herd seen in the background. In this way the seals are divided and driven to the killing grounds. Fig. 2—A cow seal with her pup. The female soon leaves her offspring and swims away seaward 100 miles or more, but can single out her progeny from among thousands on the beach when she returns to land. Fig. 3—Pups just beginning to swim. These little fellows do not go into the water for the first few weeks of their existence, and it takes some time for them to learn how to swim.

Natives skinning a seal. It looks like a crude operation but the work is done skilfully.

and mosses, too, are plentiful, but not a tree is to be seen.

To the picturesque shores of these far-away islands hundreds of thousands of fur seals come each year for breeding. They arrive in May and stay until December, during which period many little fellows look out on the world for the first time. Frolicsome pups they are, wriggling and tumbling about for a few weeks on land, taking their swimming lessons from day to day and, finally, departing with the great army that goes south through the Aleutian passes, then eastward into the North Pacific Ocean, and down the coasts of British Columbia and the United States as far as California.

But a part of the multitude is not permitted to go away with the rest. About 30,000 of the so-called bachelors or non-breeding seals are singled out from the legion and driven back toward the killing grounds. The Aleuts, whose ancestors were first drawn upon by the Russians to colonize the Pribilofs, are the herders for Uncle Sam, as were their forefathers for the Czar and for the commercial companies which leased the islands before the United States took possession. They know the habits of the seals as the farmer knows his stock, and they round them up cunningly and rapidly. Approaching slyly, the natives run quickly between the dozing seals and the surf and turn thousands of them away from the water. When the animals are first startled they arise and, seeing men between them and the water, immediately look the other way and lope and scramble hurriedly back over the land. The natives then leisurely walk on the flanks and in the rear of the droves—three or four men generally being sufficient to guide as many thousand seals.

At the start, the creatures are grouped in many small pods but, finally, are turned into one big army. On they go like sheep, walking, as it were, by means of their front flippers. They raise themselves by striking out simultaneously with both forefeet, and then drag the whole body forward. Slowly, by this shambling, wobbly mode of progression, they reach the killing grounds, where they are put to death in the most humane and effective way—a blow on the head with a heavy club and a stab in the heart while unconscious. The seals are next skinned with great care and skill—a layer of fat of from one-fourth to one-half inch in thickness being left on the skin to help keep it in the moist, flexible condition desirable for proper dressing.

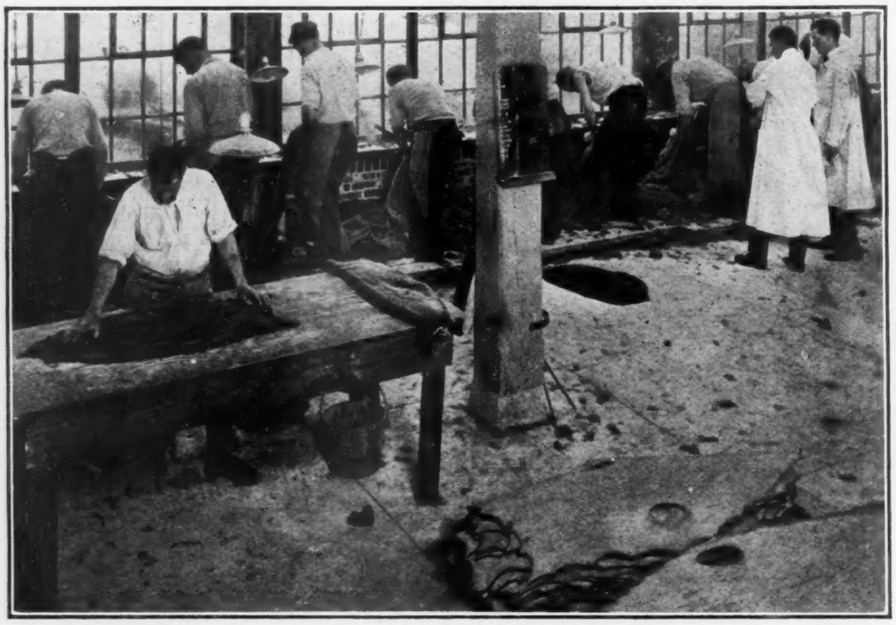
An old bull seal. An ugly customer to tackle at certain seasons.

The natives are masters of the art of skinning, which is done with a knife much the same as the work is accomplished in packing houses; and they are paid a fixed rate for each skin—fifty cents for one kind and a dollar for another. The long years of employment have given them manual cunning, and the more expert of the Aleuts can skin a seal in five minutes. After that comes the curing.

For this purpose the flesh side of each skin is covered with a generous layer of salt, and is left in that state until the mineral has taken effect. Thereupon the old salt is removed and a thin layer of fresh salt is sprinkled on the skin, which is then rolled and tied into a tight, compact bundle—with only the fur side exposed to the air to prevent the drying and the hardening of the pelt—and packed tightly into oak barrels. Hundreds and hundreds of these sturdy containers with their precious cargoes are placed aboard a steamer bound for Seattle, from whence they go by train to St. Louis—the fur center of the world. For some years after the United States Government went into the fur business, the sealskins were sent to England to be dyed and dressed. Englishmen then held the trade secrets and were the recognized leaders in the production of fine skins. But the long journey to and fro made prices almost prohibitive: the return of the skins to an American port amounted practically to the importation of a foreign product, for a 50 per cent. *ad valorem* duty had to be paid. The logical procedure, therefore, in order to protect the domestic buying, was to build up an organization of ex-

The long guard hairs are removed by the scraping action of a blunt knife.

Fig. 1—Removing the last of the blubber from the skins. Oil extracted from this blubber is used in tanning the skins. Fig. 2—Here the skins of the raw pelts are given a finish which makes them as soft as chamois leather. Fig. 3—Giving the dressed sealskins their final touches. Fig. 4—Removing such of the shorter guard hairs as were missed during the first unhairing operation. Fig. 5—Brushing the dye in by hand.



Cleaning and washing skins to rid them of dirt, oil, and grease.

perts in America—men who could teach others to do the work—and this the Government proceeded to do. With a few of London's best as a nucleus, a splendid 100 per cent. American company was accordingly established in St. Louis, and there the skins are now not only dyed and dressed but are sold at public auction under the supervision of officials of the United States Bureau of Fisheries. The company, working on a commission basis, is in reality but a trustee, and holds the skins during the various operations much in the same manner as any other fiduciary corporation or individual.

Many people believe that the skin on the animal and the skin in the finished coat are much alike, but this is a mistaken idea. The fur seal has two distinct coats of hair—an outer one, of course and rather stiff guard hair, and an under coat which is the true fur or down. The latter is just about half as long as the guard hair, and is never seen on a live seal. It has been said that Nature does all things well, and the fur seal is further proof of her providence. The outer coat has been called the seal's suit of armor, and amply does it serve him as he scrambles about and fights his fellows on the stone rookeries. The soft, fine fur underneath has been likened to an insulator that protects him from the cold water. Remember, the fur seal revels in the water whether it be June or December; and ice packs or wide frozen areas have no terrors for him.

The first thing that is done at the St. Louis plant is to remove the layer of blubber which the natives left on the skins and to give them a thorough washing to get rid of all dirt, oil, and grease. Next, the coarse guard hair is extracted, and this is a unique feature of the process. It is not cut off or plucked, as is the case in the treatment of other furs, but is taken out by the roots, thus giving a much more beautiful and velvety product. In order to accomplish this, the pelt is exposed to dry air at a high temperature, and so treated the hair comes out quite easily as the workman wields a curved, blunt knife over the surface. But the procedure is not as simple as it sounds. According to a pamphlet issued by the United States Bureau of Fisheries some years ago: "No matter how carefully the unhairing process is performed, a number of hairs are broken off near the surface of the fur, and there remain many of young growth not yet above the surface. . . . For years these hairs were removed by hand, and the girls employed in this work required from one to five days to complete a single skin." Now, however, ingenious pneumatic machines have been devised which extract the hairs quickly and effectually. Upon the completion of the unhairing, the pelt is tanned or dressed in the seal's own oil extracted from the blubber in the first operation; and this produces the soft, flexible leather necessary in the effective tailoring of a fashionable garment. At this point it seems proper to correct another false impression regarding the Alaskan fur seal: it concerns the color of the animal's coat.

Most people will, perhaps, be surprised to learn that even the under coat of a live seal is not particularly pretty in color though soft and velvety to the touch. It is a mixture of gray and light brown, and the expert must change this into the darker shade so pleasing to the feminine eye. This process is, indeed, a difficult one. The genuine sealskin coat is not all black: the lower half of the hair is a rich, chocolate brown. This exquisite combination is obtained by brushing the dye in by hand—a tedious job, at best. The length of the fur on a seal varies—being about three-quarters of an inch long between the shoulders and one-quarter of an inch long on the breast. The dye is so applied that the black coloring matter goes just half way down from the tips of the fur, regardless of the length. And each pelt receives at least twenty applications of dye. Scores of men stand at long tables and carefully dip and brush, dip and brush, until just the right shade is obtained. After that the thickness of the pelt must be reduced so as to give to the finished leather the maximum softness and flexibility.

The Government agents have acquired such skill in the treatment of the skins that they can now produce a seal coat that weighs little more than a cloth coat of the same size. This is one of the most important factors in the industry, for the only objection to the old-time sealskin garment was its great weight. Lastly, the pelt is thoroughly examined and put through specially made machines for the purpose of removing the shorter guard hair that may have been missed in the first unhairing operation. The finished product is a delight to the eye; and is all the more marvelous because of the transformation. The uninitiated can scarcely believe that the exquisite fur could possibly have come from the coarse, rather drab pelts orginally received from the far-away Pribilof Islands.

The skins are now ready for the furrier;

Finished sealskins displayed for buyers from all parts of the world.

A party of Aleuts. For generations these people have caught and skinned fur seals.

and buyers from all over the world rush to St. Louis when the sales are announced and tumultuously bid for the skins at public auction. The market fluctuates, as do other markets; but Uncle Sam does a big business at each and every sale. The average price per skin is about $40. This seems rather low, in view of the known cost of sealskin coats; but it must be remembered that it takes several skins to make one garment. At the end of a year the Government, because of its fur-seal fisheries, is richer by a million and more dollars; as a matter of fact, the United States Treasury has realized from the fur seals of Alaska alone more money than it paid for that land of untold wealth.

There was a time when cedar chests and camphor were relied upon by womankind to protect their furs from the ravaging moth. Nowadays, she sends them to cold storage where the temperature is held low enough, month in and month out, to arrest the propagation of these destructive insects. Once more we see the ever-widening application of artificial refrigeration, and, curiously, how low temperature of man's making serves to safeguard the very furs which Nature provided in the first place to keep her creatures warm in the frigid waters of the Far North.

PICKING COTTON BY SUCTION

An automatic cotton picker has recently been invented in Melbourne, Australia. The machine is portable and can pick, so it is said, an acre of cotton in much less time and at a lower cost than the work can be done by hand. The method of picking is by suction. The outfit is seventeen feet high and four feet in diameter, and consists of a circular tower carrying two horizontal arms having a 35-foot spread. These arms are eight feet wide and have a series of holes on their under sides.

The ripe cotton is drawn into the hollow arms and carried along to a central chute, where it is compressed into bales that drop out at the rear of the machine. An 8-H.P. engine is used for motive power; and the total weight of the picker is about 1,500 pounds.

COMPRESSED AIR EMPTIES ACID-FILLED CARBOYS

Handling clumsy carboys filled with acid has been robbed of many of its dangers through a device designed by a safety engineer of the Cadillac Motor Car Company, Detroit, Michigan. It was formerly the practice for two men to hoist these cumbersome bottles by hand and to pour their contents into large pickling vats in the heat-treatment building, where the acid is used for the purpose of removing scale from steel forgings. The steam rising from the hot pickling solution often cracked the glass necks of the acid carboys, and, as a result, the workmen handling the bottles not infrequently suffered cuts on hands and faces, or their clothes were burned by the splashing acid.

The new device consists of a special bracket and clamps of bronze carrying a snugly fitting rubber stopper through which a rubber hose leads down into the carboy; and compressed air is used to force the acid out of the container. The compressed air supply of the factory was reduced to a pressure of five pounds per square inch by installing an air-pressure regulator, a pressure gage, and a safety relief valve.

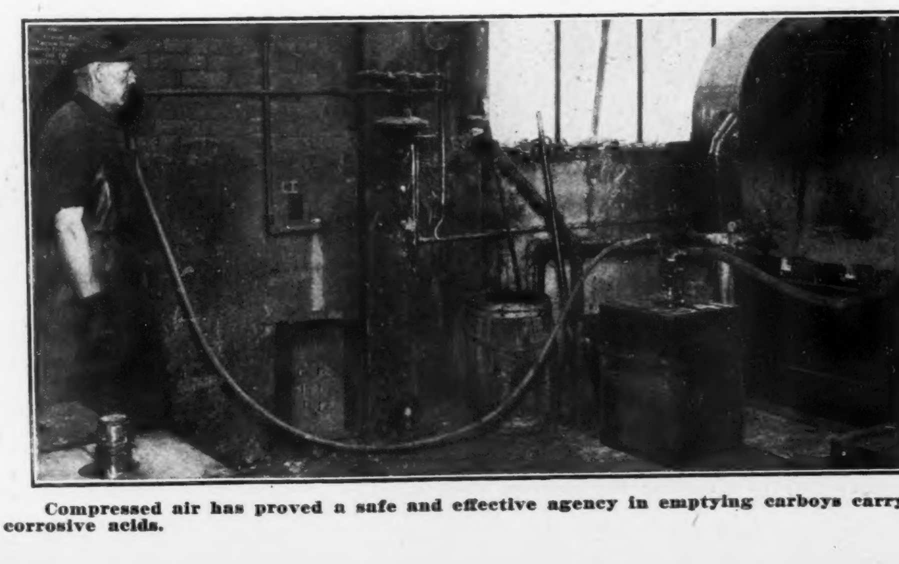
The new system makes it possible to place the carboys at a safe distance from the steaming vats. The stopper is inserted in the mouth of the bottle and clamped onto the neck; and then, by simply starting the flow of air, the acid is forced through a 1-inch diameter hose into the vat. In consequence, the acid is fed without splashing; one man can now do the work that formerly called for two; and the man on the job need no longer fear serious injury through some mishap to the bottles.

FEATS OF THE OXYGEN BLOWPIPE

The breaking up of large, solid masses of iron or steel, for the purpose of remelting, has heretofore been such a slow and costly operation as to be seldom indulged in, and many blocks of metal of this kind have therefore been abandoned as worse than worthless. The oxygen blowpipe, a cheap and simple apparatus and quick in operation, has wonderfully changed all this. Here we have a cylindrical mass of metal, technically known as a "ladle set," over six feet in diameter, of equal length, and weighing more than 45 tons. A most hopeless case.

A long piece of ¼-inch iron pipe is connected by flexible hose with a "bottle" of oxygen. The free end of the iron pipe is made red hot, and the oxygen is slowly and carefully turned on. The end of the pipe begins to burn with intense heat; and when this end is thrust against the block it begins to bore a hole right into the mass to a depth of three feet or more. The hole will be, say, an inch in diameter, and the molten metal will flow out of it in a little stream. In this way a considerable number of holes are quickly burned. These are charged with gelignite and are fired all at once after the block has been placed in a special pit. Thus is obtained a mass of pieces that are generally as small as required.

It has been found by actual count that the flow of traffic over the Chicago Michigan Avenue Link Bridge exceeds that of Fifth Avenue, New York, by nearly 50 per cent., and that 53,014 vehicles cross the span between 7 A. M. and midnight, or an average of 3,118 an hour with a maximum of 4,360 during the rush hour.



Compressed air has proved a safe and effective agency in emptying carboys carrying corrosive acids.

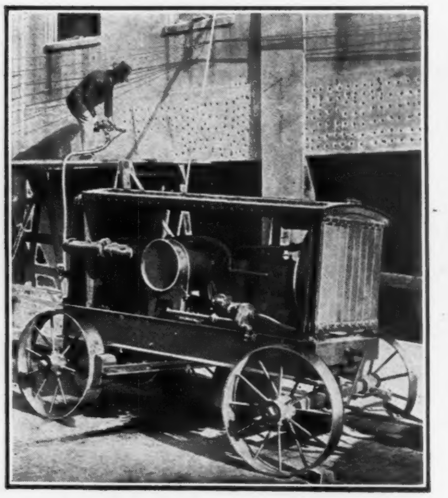
Compressed Air Proves a Boon to the Building Industry

BY ROLAND H. BRIGGS

THE RATTLE of riveting hammers and the chatter of chippers have become familiar accompaniments to steelwork in modern building practice. Portable air compressors are now included in the plant of the up-to-date building contractor; and it is not surprising that compressors and pneumatic tools should likewise be employed in other building operations. In English building practice, compressed air was never before put to so many services as recently during the erection of a great municipal structure. The use of pneumatic tools in steel construction, in foundation work, and in cutting plug holes in ferro-concrete for wall and ceiling fixtures, etc., are familiar operations too well known to the readers of this Magazine to need any description here. But the work shown in the accompanying photographs indicates that the progressive contractor can find additional directions in which compressed air will save him both time and money.

In the particular case in question, the sums of money involved for all contracting and subcontracting work were very large owing to the size of the structure. Thus a very serious problem arose when it was found that the operations of the sub-contractors for heating and ventilating equipment were being delayed owing to the time taken in cutting holes and in channeling—it being impossible with hand labor to push this work forward fast enough to keep up with the engineers. The most urgent and difficult job was the cutting of holes of about 2¼ inches in diameter for radiator pipes, situated in a most awkward position, through from 18 to 24 inches of Yorkshire blue brick. The possibilities of compressed air in this connection were clearly demonstrated by tests.

The first test was with a hole 2¼ inches in diameter through a blue-brick pier 18 inches



A portable compressor furnishes air for the driving of a "Jackhamer" used in drilling a large number of holes through heavy concrete.

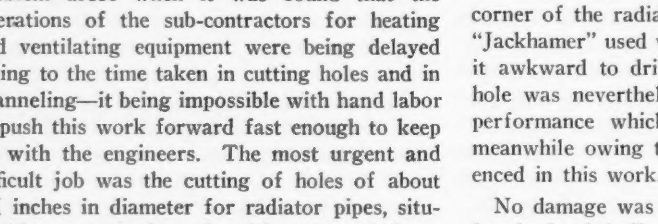
wide—this hole being required to make a connection between a heating main and a radiator. The hole was located in the right-hand, top corner of the radiator recess. The grip on the "Jackhamer" used was left-handed, which made it awkward to drill the hole; but a clean-cut hole was nevertheless made in six minutes—a performance which has been reduced in the meanwhile owing to the men becoming experienced in this work.

No damage was done to the brickwork; and hundreds of similar holes havesince been drilled. Some difficulty was encountered in the experimental stage owing to the shape of the drill point used. A plain bit was first tried, but this, immediately taking the mortar as the line of least resistance, quickly became wedged and stopped the machine. A cross-bit was then tried, and with this steel the results were entirely satisfactory. As one face of the cross-bit was always in contact with the harder material, the hole was kept in perfect alignment without being affected by the mortar.

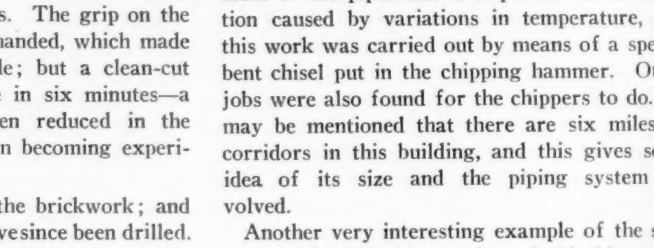
An accompanying illustration shows a workman drilling one of these return connections from a radiator recess to a pipe recess; and a very important point to note in regard to operations of this nature is that the drilling did no damage to the marble skirting, which was in position when the holes were drilled, or to the plaster or the other finished work. There were doubts about this in the beginning. The "Jackhamer" employed was equipped with automatic rotation; and an air jet through the hollow drill steel cleared away the debris.

The chipping hammer, shown in one of the photographs, was also used in making the radiator holes, as well as in the extensive work of cutting chases in concrete floors for piping. The radiator pipe holes had to be increased in diameter in the center to allow for the movement of the pipes due to expansion or contraction caused by variations in temperature, and this work was carried out by means of a special bent chisel put in the chipping hammer. Other jobs were also found for the chippers to do. It may be mentioned that there are six miles of corridors in this building, and this gives some idea of its size and the piping system involved.

Another very interesting example of the saving of labor in the erection of this big structure was in connection with some work done on the ground-floor air duct. The duct in question was eight feet wide but only two feet high, and the holes required were about six inches



Roughing a concrete floor with a pneumatic chipper preparatory to spreading the finishing coat.



Drilling a 2¼-inch hole through Yorkshire blue brick to make the piping connection for a radiator.

by four inches and led from the air duct into the elevator well. The men were forced to lie flat; and hand cutting was, in consequence, almost impossible. By means of pneumatic tools, however, the particular job was easily and satisfactorily done.

Air for the initial tests was supplied by one of the compressors driving the riveters in putting up the structural steelwork; but as soon as the great savings in labor were demonstrated and the tools were adopted for regular use, then an additional portable compressor was installed to meet the extra demand for air.

What pneumatic tools make practicable is shown in the case of a doorway, tapering towards the top, which was cut through about five feet of solid concrete and into a chamber in the retaining wall used for housing a pumping plant. The wall of this chamber is as thick as the wall pierced through, because the whole building is constructed on a huge saucer-like raft, which practically floats on water. If the water should rise above a certain level, the pump in this chamber automatically starts working, so that all danger of flooding is prevented. Various other examples of work carried out to great advantage by means of these air tools could be cited, but it is desired only to mention those that seemed most unusual. The one fact made clear is that as soon as a portable compressor and associate tools of one kind or another are included in the contractor's plant the men in charge very soon find many uses for them; and a call for increased compressor capacity is likely to result rather than a shortage of work for the pneumatic equipment.

A practical hint with regard to the arrangement of the compressor plant may be given to those progressive contractors who wish to avail themselves of the benefits which compressed air has to offer. It is essential that the turning radius of the equipment should be as short as possible, so as to enable it to be turned into a room from a narrow corridor or around sharp corners; and in the case of the plant described, the compressor, the electric motor, the electric starter, and the cooling-water tank were mounted on one trolley while the air receiver was on a second trolley, so that all corners were easily negotiated. A temporary 2-inch main was laid from the compressor along the corridor or around the bay where the drilling was to be done, so that the work could be carried on with very little interruption. After starting up, the compressor set was left unattended—it being automatically controlled by an unloading valve.

Stone and granite carving and dressing, drilling holes in steel window frames, cleaning steelwork prior to painting, sand screening, and many other operations are more conveniently performed by compressed air than by any other medium; and the varied uses of the cement gun in the building trade are daily becoming more and more important. But every structural undertaking has its own problems and its own requirements; and this article will have served its purpose if it has demonstrated to the reader

The "Jackhamer" proves speedy in drilling holes in concrete for window bolts.

the efficient way in which compressed air surmounted some of the difficulties met with in the particular case described.

Editorial Note:—The foregoing article points out only some of the many less common uses to which pneumatic tools are put in the building industry. In the United States numerous builders have taken advantage of the "Jackhamer" for drilling holes in masonry for pipes, electric conduits, gas and water-service connections, and in the placing of window frames, etc. In manufacturing plants, similar tools are employed to drill bolt holes in foundations and the like. The more recent appearance of the paving breaker has increased the use of pneumatic tools for demolition work where it is necessary to make structural changes, open up trenches for conduits, and for kindred operations.

RACK PROVES USEFUL IN TESTING AIR PUMPS

IN ORDER to speed up the work of connecting and disconnecting steam and air pipes, when testing locomotive air compressors, it was decided to install a rack at the shops of the Michigan Central Railroad at Jackson, Mich. This rack is proving a great convenience, according to C. W. Adams, superintendent of the shops.

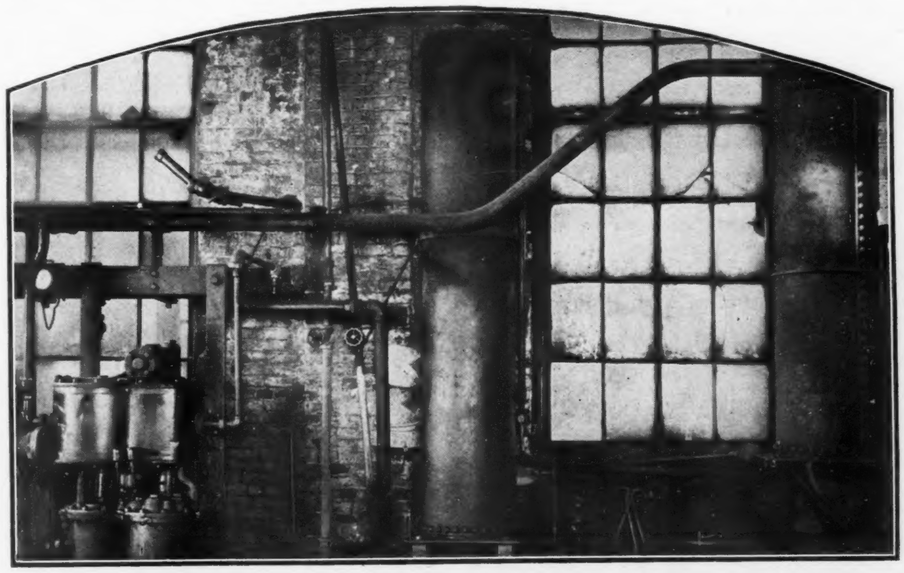
The steam connections are fitted with Barco flexible joints, and these have been found to be very suitable for the purpose. The discharge air line leads into an air receiver that is linked up with the shop system, thus storing up pressure for future use. In setting up a pump for testing it is not necessary to make any changes or adjustments other than to attach the nipples to the pump and to make the proper connections with the flexible leads.

The vertical members of the rack are so spaced as to accommodate the various-sized pumps that are brought into the shops for repairs. Stirrups are bolted to the uprights, and in these the pump lugs are supported. Bolts are inserted through the top lugs to prevent a pump from moving while it is being tested. An air hoist is available for handling the pumps on the repair bench and for lifting them to and from the rack.

We have to believe that bacteria, which only microscopes of high power—if you call it power—will reveal, are about the smallest of living things yet discovered. The *Journal of the American Medical Association* has weighed a typhoid bacillus, and only a deal of arithmetic can help us to arrive at the actual figures.

A cylinder the size of one of these little beasts, with a specific gravity of 1.2, would weigh almost to a dot 0.000,000,002 milligram. It would thus take 500,000,000 bacilli to weigh a milligram, 500,000,000,000 to weigh a gram, and about 15,000,000,000,000 to weigh an ordinary ounce. Yet one of these can quickly kill a man. Whether they also have a compensating beneficient function has not yet been discovered.

During the fiscal year 1922-1923, we exported to Canada $73 worth of goods for every man, woman, and child in the Dominion.



Test rack and connections for the periodic examination of locomotive air pumps.

Ejector System For Sewage Disposal

Pumping by Compressed Air in This Manner Has Outstanding Advantages

By J. JOHNSTONE TAYLOR

PUMPING sewage is invariably something to be avoided if possible. Fortunately, the natural configuration of the ground permits gravitation systems to be laid out in most small towns, except in those on flat sites, because the length of the mains is comparatively short and enables a natural fall to maintain a self-cleansing velocity. On the other hand, in flat locations—especially where the main sewers are of considerable length as they generally are in large towns and in those situated at some distance from the outfall works—pumping will have to be resorted to.

Pumping schemes for sewage may roughly be divided into two classes:

1—The laying out in a gravity system of the subsidiary sewers so that they will all deliver into a common trunk sewer whose level is below that of the final point of exit of the sewage.

2—Drainage by gravity and by one or more trunk sewers of as many districts as possible to the outfall works, and dealing separately with those low-lying areas which cannot be drained by gravity.

Such a dual system is generally required in very large towns like London, Dublin, and Glasgow, which lie at or near a tidal estuary and have a sloping site towards the river but a flat one adjacent to it. In cases of this description, the trunk sewers are laid approximately parallel to one or both sides of the river, depending on the situation of the city, and the sewage is raised at some suitable point or points for further gravitation to the outfall works.

The pumping machinery for such systems would consist, for the most part, of steam-driven centrifugal pumps, although gas and oil, and electric power are suitable under many circumstances. On the other hand, the second method offers a somewhat different problem, and may call for several plants at which small amounts of sewage may have to be raised. The quantity to be handled at nighttime may be almost negligible, while in times of storm it may be considerable. Apart from the usual provisions for taking care of storm waters, these small pumping plants must be capable of dealing with a very variable flow, and, therefore, must be in duplicate or of a much larger size than those required normally. Hence, these plants become wasteful to operate and costly to maintain—not being automatic in action, practically constant attendance is necessary to take care of a storage tank built to permit intermittent pumping. The latter course entails putrefaction of the sewage—which is detrimental to final purification—while some sort of screening gear is necessary to prevent choking of the pumps. The latter require periodical cleaning.

On the other hand, although the central pumping station as applied in the first case can, in all probability, be efficiently worked, the cost of a long-length, low-level intercepting sewer may be considerable, and there are many instances where it would be both prudent and economical to divide up the area and to install separate pumping units. These small plants are, as before stated, not economical; and the ejector system, with which we are concerned, will in many cases prove a better solution of the problem of dealing with small quantities of sewage.

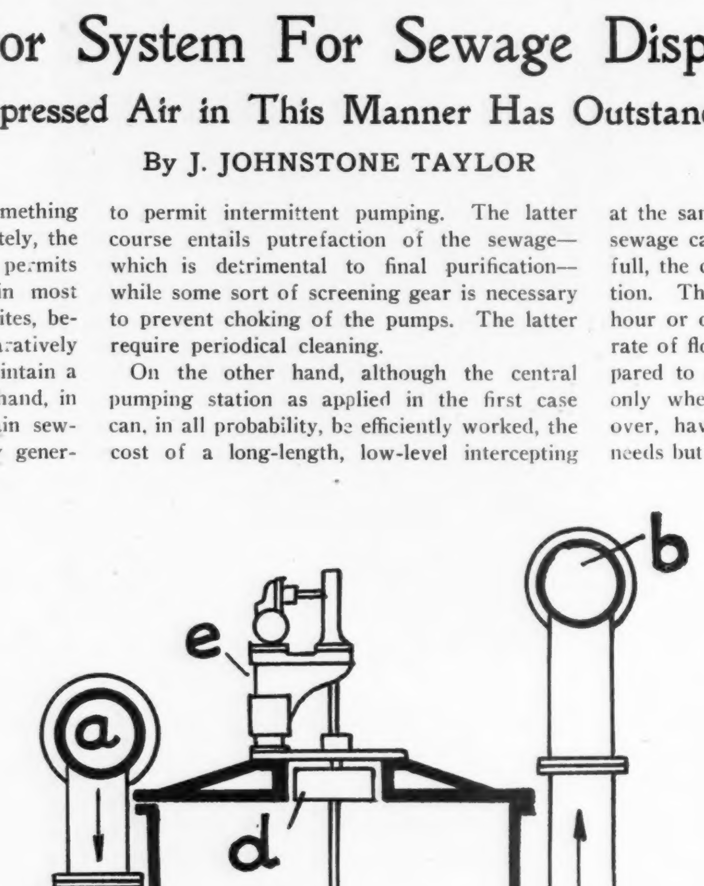


Fig. 1

The sewage ejector is not by any means new; but it is a useful method of raising liquids a moderate height. It is an apparatus whose value is not always properly appreciated. Primarily designed for the purpose of dealing with sewage from isolated buildings which cannot be drained into the mains by gravity, it is being gradually extended to take care of more or less large sections of populous towns. One advantage of the ejector is that it can handle the smallest flow while having, at the same time, a big reserve capacity. The sewage can feed into it freely and, when it is full, the contents can be ejected at one operation. This ejection may take place once an hour or once a minute: it is just a matter of rate of flow. In fact, the ejector may be compared to a large pump which makes a stroke only when it is required to do so. Moreover, having practically no moving parts, it needs but a minimum of attention and will deal with any solid matter which may possibly find its way into the sewers.

The medium for operating these ejectors is compressed air, which, as will be shown, does away with all moving parts by acting directly on the volume of sewage. The point raised by engineers against the system, as far as the consumption of air is concerned, is that it is wasteful. This, as will be brought out, is inclined to be somewhat exaggerated. The two main sources of waste are: first, inefficiency of the compressors and, second, leakage in the air mains.

As regards the first, this must be guarded against by installing the best machinery. Compressors vary greatly in efficiency; and a number of the smaller machines—built to meet a price rather than an ideal—are anything but efficient.

This brings us to the question: Is it preferable to install several small compressor units near the ejectors or one central station with its attendant long lengths of piping? In the case of small compressor units, losses in the air mains can be cut down to a minimum; but the first cost of several sets of small machines may be greater than that of one main installation of larger compressors. Furthermore, there are buildings, operation, and attendance to be considered. Generally speaking, the central compressor station will prove the most economical to maintain, and is probably the cheapest from the point of view of first cost. Moreover, it provides a reserve of power which the small unit cannot furnish. If such a plant be decided upon, those responsible must see to it that the mains shall be as tight as possible and that they remain so by reason of careful attention. Once an underground air line starts to leak it is difficult to locate that leak without exposing the whole main; but by a judicious use of air meters it is feasible to detect when and approximately where leaks are taking place so that they can be dealt with at the earliest opportunity. Apart from leaks,

there is always a loss of energy in transmitting compressed air any considerable distance.

One of the most important mechanical problems relating to air is the law governing its flow in pipes. Assuming that there is a comparatively small difference in pressure at the ends of the pipe, the volume of flow in cubic feet per minute is found by the formula

$$V=58\sqrt{\frac{pd^5}{WL}}$$

in which V=volume of air in cubic feet per minute.

p=difference in pressure at the two ends in pounds per square inch.

d=inside diameter of pipe in inches.

W=weight, in pounds, of one cubic foot of the entering air.

L=length of pipe, in feet.

From this formula it will be observed that, as V varies with d^5, the use of pipes that are too small will have a serious effect on the delivery of air, which might have a serious effect on the working of the ejector at times of maximum flow. In consequence, pipes of liberal diameter should be installed. Moreover, as far as practicable, these pipes should be free from bends; and the lengths of the main should be laid on easy gradients with moisture traps at the lowest points. With a known maximum volume to be transmitted, the size of the pipe required can be readily ascertained from tables on air transmission published in most engineering textbooks.

It is quite impossible in this article to go into the whole subject of air compressors. The choice of a machine, however, requires the most careful consideration. In England, electrically driven, high-speed compressors have reached a high state of efficiency and are reliable and economical machines well suited to the purpose, provided power can be cheaply obtained. These units, for the most part, are built on high-speed lines, and are totally enclosed and automatically lubricated. It must always be remembered, however, that there is a big difference between machines of this kind built by firms with years of experience in the air compressor business and those, mostly of low power, built by general engineers as a side line. The first are designed to give the utmost economy in operation and years of satisfactory service, and are, of necessity, costly. The second type is intended mainly for small installations, often of a temporary nature as might be needed at a quarry, for instance, for working rock drills. Such machines, with a comparatively low first cost, serve their purpose but have no place in permanent plants or where continuous operation is required.

The high-speed compressor, as it is understood in England, is practically unknown in America, where the better-class machines are ordinarily of the slow-speed type and largely steam driven. High-speed compressors, it should be mentioned, are entirely suitable for steam drive. Generally speaking, the high-speed type occupies less floor space than that of slow speed and requires less attention; and, being well adapted to electric drive, is often cheaper to install. On the other hand, electric power might not be available. Where it is decided to install a steam plant, the slow-speed machine may, other things being equal, show greater economy in operation; but as regards reliability there is no choice. Electricity is convenient; and, where the operation is constant, steam will probably bring about the greatest saving; but there are cases where gas or oil engines may prove the most economical prime movers, while the possible use of water power must not be lost sight of.

There are two main types of sewage ejectors constructed in Great Britain: the Shone system, built by Hughes & Lancaster, of Ruabon,

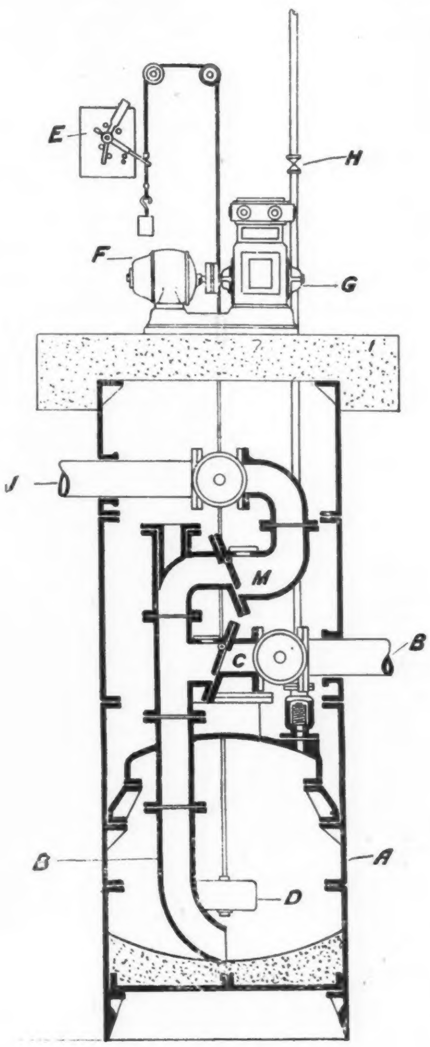


Fig. 2

Wales, and the Adamson system, built by Daniel Adamsons, of Dukinfield, England. These ejectors are designed to be installed at the lowest points in different sewerage sections, and to automatically lift all the sewage—gravitating from the respective sections—into a common main leading to an ultimate outfall for the whole area. The ejector of each section is operated by air, piped from a central compressor station, and functions automatically, that is, it is capable of dealing with a maximum volume of sewage for long periods without attention of any kind. The ejector receives the sewage from its section, fills, and, when full, ejects it directly into the main outfall sewer—the process repeating itself as long as sewage flows.

A cross-section of an ejector of this type is shown in Fig. 1, from which it can be seen that there is a minimum of moving parts and nothing that can be seriously affected by the corrosive action of sewage or foreign bodies contained therein. Referring to the lettering on the diagram, the sewage gravitates through inlet pipe, a, from the sewers and gradually rises therein until it reaches the underside of bell, d. The air confined in the bell is at atmospheric pressure, and the sewage, continuing to rise, compresses this air sufficiently to lift the bell, spindle, etc., which action opens the compressed air admission valve, e. The compressed air thus automatically admitted into the ejector presses down upon the surface of the sewage—driving the contents before it through the bell-mouthed opening at the bottom; through outlet pipe, b, into the cast-iron rising main; and thence to the outfall sewer.

The sewage can escape from the ejector only by this outlet pipe, for the instant air pressure is admitted the valve on the inlet pipe, a, falls on its seat and prevents any escape of fluid in that direction. The sewage passes out of the ejector until the weight of the exposed and unsupported cup, c, is sufficient to pull down the bell and spindle, thereby reversing the compressed air admission valve. This cuts off the air supply to the ejector; causes the outlet valve to fall on its seat and to retain the liquid in the sewage rising main; and then allows the air within the ejector to exhaust down to atmospheric pressure. The sewage flows into the ejector through the inlet valve once more, driving the free air before it, and, as the sewage rises, the process of ejection is repeated at longer or shorter intervals, depending on the measure of the flow. The cup-and-bell floats are so adjusted that compressed air is not admitted into the ejector until it is full of sewage; and the air is not permitted to exhaust until the ejector is emptied down to the discharge level.

Among other points which may be noted in connection with these ejectors is the fact that there are no machined surfaces subject to the corrosive action of the sewage; and the whole apparatus is coated with Angus Smith's solution. The automatic air valve is the only machined part, and it is not in contact with the sewage.

The action of the apparatus insures a complete discharge, including solids, grit, or sludge, at each operation—hence no screening of any kind is required. There is no possibility of back flow, because any return flow from the main is immediately trapped by the ejector non-return valve. It is also interesting to note that where a set of ejectors is working in rotation, a uniform pressure can be maintained on the rising main, which, while materially reducing the air pressure required to eject the sewage, enables the ejectors to work smoothly. This alternating gear is a feature of the Shone system that not only improves operating con-

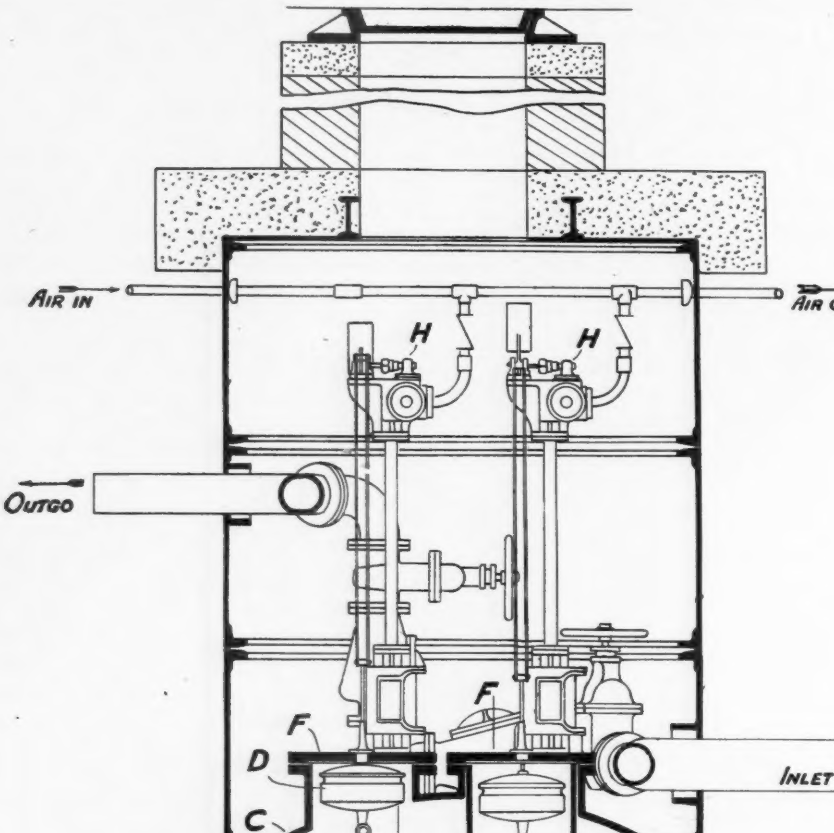


Fig. 3

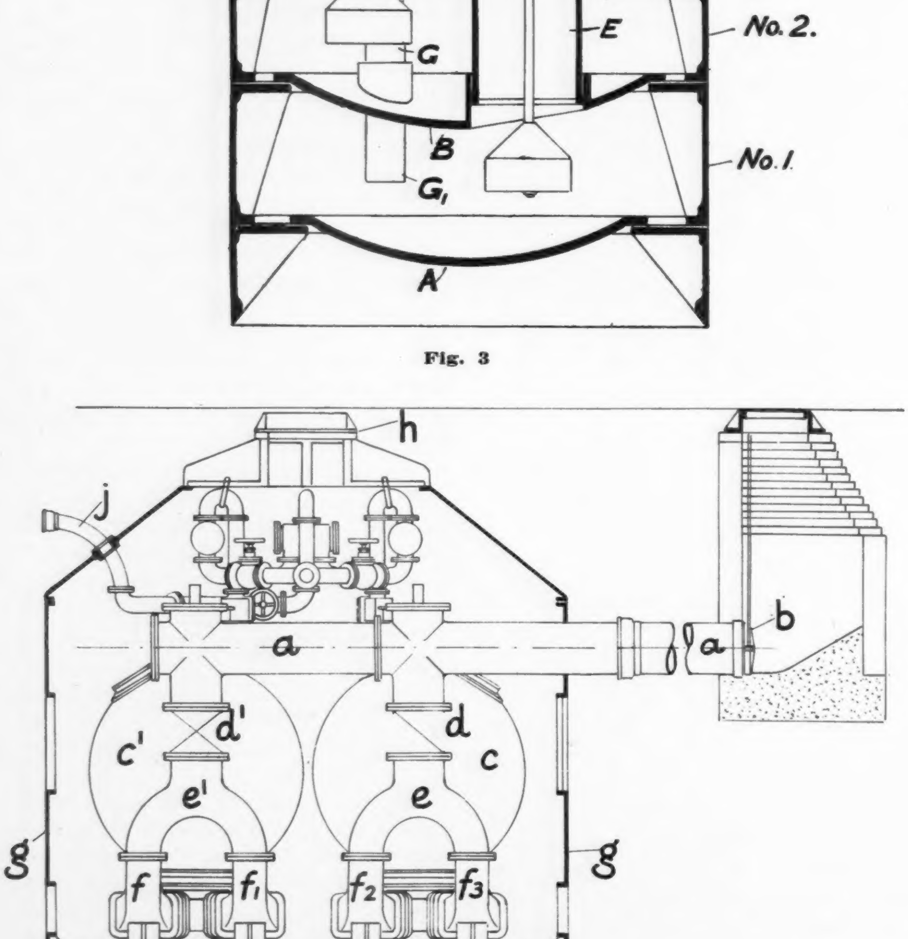


Fig. 4

ditions but also enables the ejectors to deal successfully, in times of pressure, with larger volumes than one ejector, working independently could possibly handle—thus minimizing shock in the inlet and the delivery valves when the ejectors are working at their maximum rate.

The Adamson system is shown in Fig. 2. In this type of ejector, the sewage flows by gravity into the reservoir, A, through inlet pipe, B, and flap valve, C. It rises in the ejector body, A, and lifts the float, D, which is connected with switch, E. The rise or fall of the sewage makes or breaks a contact in the circuit of motor, F, which drives the small compressor, G. It will thus be seen that this system is a self-contained one.

When the sewage attains a predetermined level in the ejector, the switch contacts are closed by the float, thus starting the motor and the compressor, and when the level of the sewage falls to the required degree the float opens the switch contacts and stops the motor. In the air line, leading from the compressor to the ejector, there is a magnetically operated valve, H, which is controlled by the float switch. When the motor is started this valve is closed to the atmosphere, and when the motor stops it is open to it. This dual action is brought about by means of a float switch, which opens and closes the circuit of a solenoid switch operating the valve. As soon as the compressor starts working, air is forced down on the surface of the sewage in the ejector. The pressure so applied closes the inlet valve, C, and drives the sewage from the ejector past outlet flap valve, M, into outlet pipe, J, and then into the rising main through which it is forced into the desired outfall. The ejector continues to discharge until the float opens the switch contacts. This action stops the motor and opens the exhaust valve, H. In this way the compressed air left in the ejector is allowed to exhaust into the atmosphere. As the air pressure is being exhausted, the weight of the sewage in the rising main closes the outlet flap valve and the ejector begins to refill—the cycle of operations being repeated automatically as long as any sewage flows from the sewers.

This self-contained system is entirely different from that previously outlined. It is essentially suitable for small installations where there is but one unit such as would be required in the basement of a city building, whose level is below that of the sewers, or in a restricted low-lying section of a main drainage scheme. It is generally preferable to a small pump and a motor because it eliminates a storage tank—the disadvantages of which have already been noted.

In the Adamson type of ejector, the pressure and the volume of the air used are in direct proportion to the volume and the weight of the liquid to be lifted. As the head or weight of the sewage on these ejectors is comparatively small, the air compressor may be of the low-pressure type, and, therefore, the heat losses during compression are absent. In addition to this, the compressor works only intermittently so that the periods of rest keep it cool and thus eliminate cooling tanks. Of

course, in some cases, it may be preferable to allow the motor and the compressor to run continuously and, instead of stopping the motor when the ejector is empty, to have it run light by means of an unloading device—the idea being to run the compressor light when the ejector is filling and to load the compressor for emptying. Both actions are automatic. Alternatively, when dealing with small flows, the motor and the compressor may be operated intermittently as described, but when the flow exceeds a predetermined limit the motor and the compressor will start to work continuously and will load and unload as just outlined.

In the accompanying diagram of the Adamson ejector, Fig. 2 shows a cast-iron tub, which constitutes a part of the ejector, itself, with a dome-shaped cover or top. The inlet and the discharge of liquid to and from the ejector body take place through one pipe, extending down through the cover, and the usual inlet and discharge sluice and reflux valves are arranged on the upper part of this pipe. The tub or ejector body is built up of cast-iron rings, the bottom one of which has a cutting edge to facilitate sinking. The internal flanges are bolted together and tightly calked with lead from the inside. The ejector may be operated electrically, as indicated, or, in the absence of electric power, it may be fitted with a float-operated compressed air valve gear.

In Fig. 3, Adamson ejectors are shown in tandem, that is to say, the top of No. 1 ejector is formed by dome, B, while a second cover, C, constitutes the top of No. 2 ejector. The inlet and the discharge of sewage to and from the ejectors take place through pipes, G and G¹, which extend down through covers, B and C; and the usual inlet and outlet sluice and back-pressure valves are arranged on the upper part of these pipes. The ejector bodies are built up of complete rings instead of segments in order to strengthen the construction and to reduce the number of joints; and a suitable alternating gear insures continuous discharge.

Although there are several advantages in working the ejectors from a central compressor station where large installations are concerned, self-contained units also have their merits, especially when placed widely apart. Storing air in a receiver, which is essential when operating a central compressor plant, entails building the pressure up above working pressure and then expanding it down to working pressure. For instance, with ejectors operating at, say, 20 pounds per square inch, it may be desirable to pump up to receiver pressure of 100 pounds to the square inch. The approximate power required to compress 100 cubic feet of air to 20 pounds terminal pressure is 9 H.P., while that needed to compress the same volume to 100 pounds is 20 H.P. Moreover, the self-contained unit cuts out receiver and transmission losses which are much enhanced when the ejectors function very intermittently, as do small units, because any leakage is bound to be continuous. On the face of it, while several small units cannot be economically worked, there may be instances where they may prove more economical than a central compressor station, and such instances will usually be found where the ejectors are scattered and the volumes to be dealt with are small.

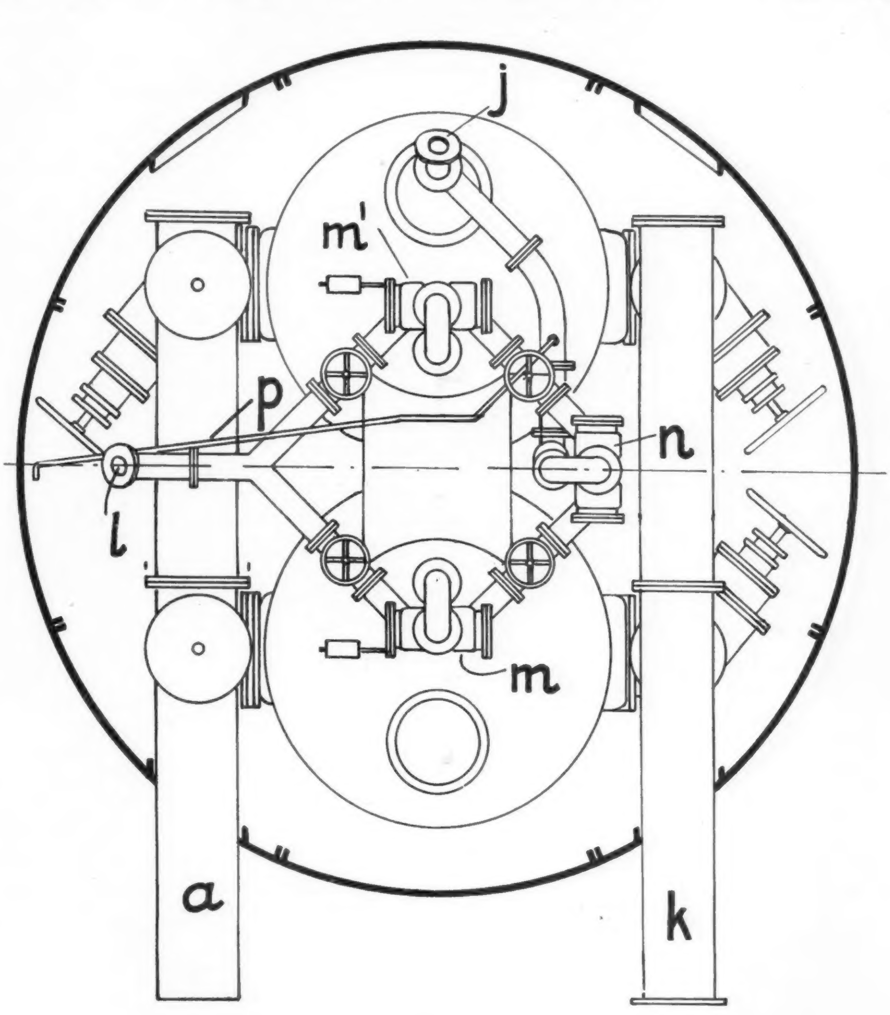


Fig. 5

The ejector system for small, self-contained sewage pumping plants has now been so widely adopted that it requires little or no further comment. Its application on a large scale, however, has been gradual: the first town to make a notable use of ejectors being Eastbourne, England, where several plants have been built since 1880. The advantages of the system have been fairly well recognized; and among the largest installations are those at Cairo, Egypt, with a capacity of over 34,000,000 gallons per day; Rangoon, Burma, rating 40,000,000 gallons daily; Bombay, India, having a diurnal flow of 36,000,000 gallons; and Concepcion, Chile, handling 8,000,000 gallons per day. The latter plant was completed in 1913, and consists of four large ejector stations operated from a central power house.

The arrangement of one of these ejectors, which are of the Shone type, is shown in Figs. 4 and 5, and may be taken as typical of modern practice. The sewage enters the cast-iron main, a, which has a stop valve at b. It passes to two ejectors, c and c¹, by sluice valves, d and d¹; the Y pipes, e and e¹; and the reflux valves, f, f_1, f_2, and f_3. The whole arrangement is placed within the cast-iron chamber, g, which has a manhole at h. Brick or concrete chambers can be used in place of those of cast iron, but the latter material is more suitable for bad or wet ground. Compressed air enters through a 5-inch pipe at j. The air valves and the other mechanism, referred to in connection with Fig. 1, are above the inlet pipe, a, while the delivery pipes are behind and cannot be seen. In the plan view, Fig. 5, the inlet pipe is indicated by a, the delivery pipe by k, the air inlet by j, and the air exhaust by l. The two automatic valves are at m and m¹, while the alternating valve, a ¾-inch scavenge pipe, is at n and p.

The plant at Cairo is a very extensive one, the system being divided into 63 areas each of which is provided with a Shone ejector. The necessary air is supplied by a central station where steam-driven compressors are arranged in four units—three being required for the maximum dry-weather flow and four in wet seasons. The maximum air pressure is 25 pounds per square inch; and all the compressors are driven by triple-expansion steam engines taking steam at 160 pounds pressure. The machines are of the slow-speed, horizontal type. The air is dried and cooled in an aftercooler attached to each compressor and is finally delivered into air receivers placed outside the power house. The flow of air through each of the mains is measured by a Venturi meter so that abnormal consumption and leaks can be detected.

This plant, which was completed in 1919, has proved entirely satisfactory after most severe tests—continuing its work after a heavy,

3-hour rain storm, during which the precipitation amounted to .985 inch in one hour. The average annual rainfall in Cairo is less than this, in fact .9 inch, so the extra load put on the plant may be appreciated.

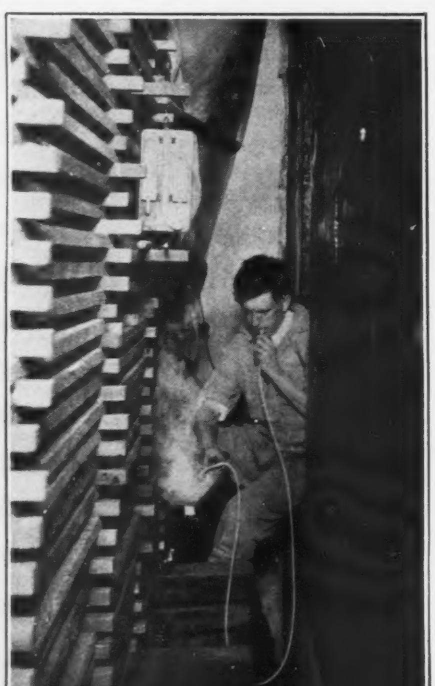
AIR RESISTANCE OF CARS

THE NEWER cars travel more comfortably at 40 miles an hour than the older ones did at twenty, and the increased comfort has helped the driver to forget that it takes as much power to overcome inertia and wind resistance at any given speed as it ever did. Actual tests show that a car of a certain body shape and driven at 50 miles an hour requires 22.6 H.P. to overcome the wind resistance, while the same car running 30 miles an hour needs only 4.8 H.P. Another car with a different body shape requires 10 H. P. at 50 miles an hour and 2.5 H.P. at 30 miles.

DETERMINING PRESENCE OF AIR IN LUMBER KILN

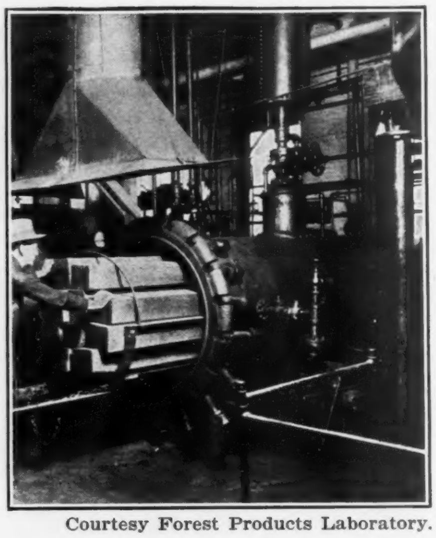
THE NORMAL process of drying lumber by sunshine is all too slow for the vast timber-producing industry. Therefore, the bulk of our lumber is now seasoned by circulating air through piles of green timber stacked in kilns. This method is entirely satisfactory provided the air is freely circulated, a condition that is not always assured. In consequence, the United States Forest Products Laboratory recently developed a system for determining the movement of air in a kiln.

A combination of hydrochloric acid and ammonia fumes, when blown through a pile of timber, indicates whether or not the air is circulating in a proper manner. The fumes, at approximately atmospheric temperature, remain stationary unless disturbed by air currents. With this in mind, the Forest Service has therefore devised suitable apparatus for blowing the mixture of hydrochloric acid and ammonia so as to indicate the presence or the absence of freely moving air essential to the curing of timber.



Courtesy Forest Products Laboratory.

Testing the direction and the velocity of air circulating in a dry kiln by means of fumes of ammonium chloride.



Courtesy Forest Products Laboratory.

Increasing the life of railroad ties by preservative treatment.

PROFITABLE READING

BY LINWOOD H. GEYER

IT IS a matter of common knowledge that continual improvement is being made in the design and the construction of air compressors. Many persons know that these betterments are brought about by engineers working in collaboration with splendidly equipped research laboratories. Each step forward leaves its record on some near-by scrap pile, the "Happy Hunting Ground" of unsuccessful experiments.

But out of all this effort and seemingly wasted material come the real improvements, so that the scrap pile, after all, stands as a monument to progress. In the case of the air compressor, it represents the hard road that has been traveled to produce the present machine that is easy to understand and easy to operate —in short efficient and dependable. So much for the compressor, itself; but how many of those whose duty it is to operate a compressor realize the trouble and the pains taken in preparing instruction books, cards, and lists of parts that are sent to the purchaser so that the man in charge of the machine may have a full and intimate knowledge of its entire get-up and method of functioning?

The wide-awake manufacturer is alive to the fact that nothing is more confusing and discouraging to the consignee than the arrival of a carload of bulky crates containing a lot of strange parts without any information as to their character and how to assemble the separate pieces so that the apparatus can be made fit to run at its best. It is because of this that enterprising makers of machinery prepare and distribute instruction books with many of their commodities. True, instruction books, as such, are not new. The buyer expects one with his newly purchased compressor just as he would if he were getting an automobile. Sometimes he looks at the book, and then, again, he may fail to do so. Indifference of the latter sort may be due to the recollection of some former instruction book which seemed principally to contain information which was not needed or desired. A good many people fail to grasp that just as machines are improved so are instruction books written with an eye to making them more valuable aids in getting the best out of a compressor. The aim is to profit by troubles experienced so that those troubles may be avoided in the future.

One large company has spent much money and time in improving its instruction books, part lists, and other printed material commonly classed under the general heading of service literature. Indeed, it has given priority to this work over that of preparing selling publicity and advertising; and it has been successful in making each new instruction book something that would enable the man who runs the machine to obtain better results from his compressor and thus to give a fuller return upon the investment of his employer.

This enterprising company has adopted the policy of asking customers for information and suggestions. The expert erecting engineers and service men employed by the company are asked to answer a series of questions and to describe how each of them erects a machine on the job. The special tricks of each erector, gained by his years of field experience, are carefully collected and digested, and from this mass of miscellaneous data is prepared the instruction book.

Further, photographs are taken in the shop so that the various associated parts may be clearly and exactly illustrated. For instance, take a crosshead: all the parts which make up the complete crosshead are grouped and a picture is taken of the unassembled elements. Then the assembled crosshead is photographed; and next a picture is taken of the crosshead in its designed place in its guides in the compressor frame. Often, for the sake of clarity, each part is lettered so that it is easy for the reader to follow the written description of any part or any operation. In fact, the newer instruction books have more engravings or cuts than are found in the bulletin, the catalogue, or other so-called selling literature. A book so prepared is not only a "how and why and wherefore" of a particular type of compressor, but it contains valuable information about piping, receivers, aftercoolers, etc., all of which concern the efficiency of the entire compressed air plant.

From time to time COMPRESSED AIR MAGAZINE has carried messages about air compressor troubles and failures that have been caused in many cases by oversight or neglect of the persons in charge of the machines—familiarity with the instruction book and heed of the information contained therein would probably have avoided most if not all of the mishaps or breakdowns experienced. Thousands of dollars and, at times, lives can be saved by following what the manufacturer knows to be best in the handling of his machines. If an instruction book is lost, don't just mourn the fact but send for another. On the other hand, if the book does not seem clear on all points, don't waste time puzzling about it but ask a representative of the maker or even the maker to help you out.

LEONARDO DA VINCI'S PECULIAR WRITING

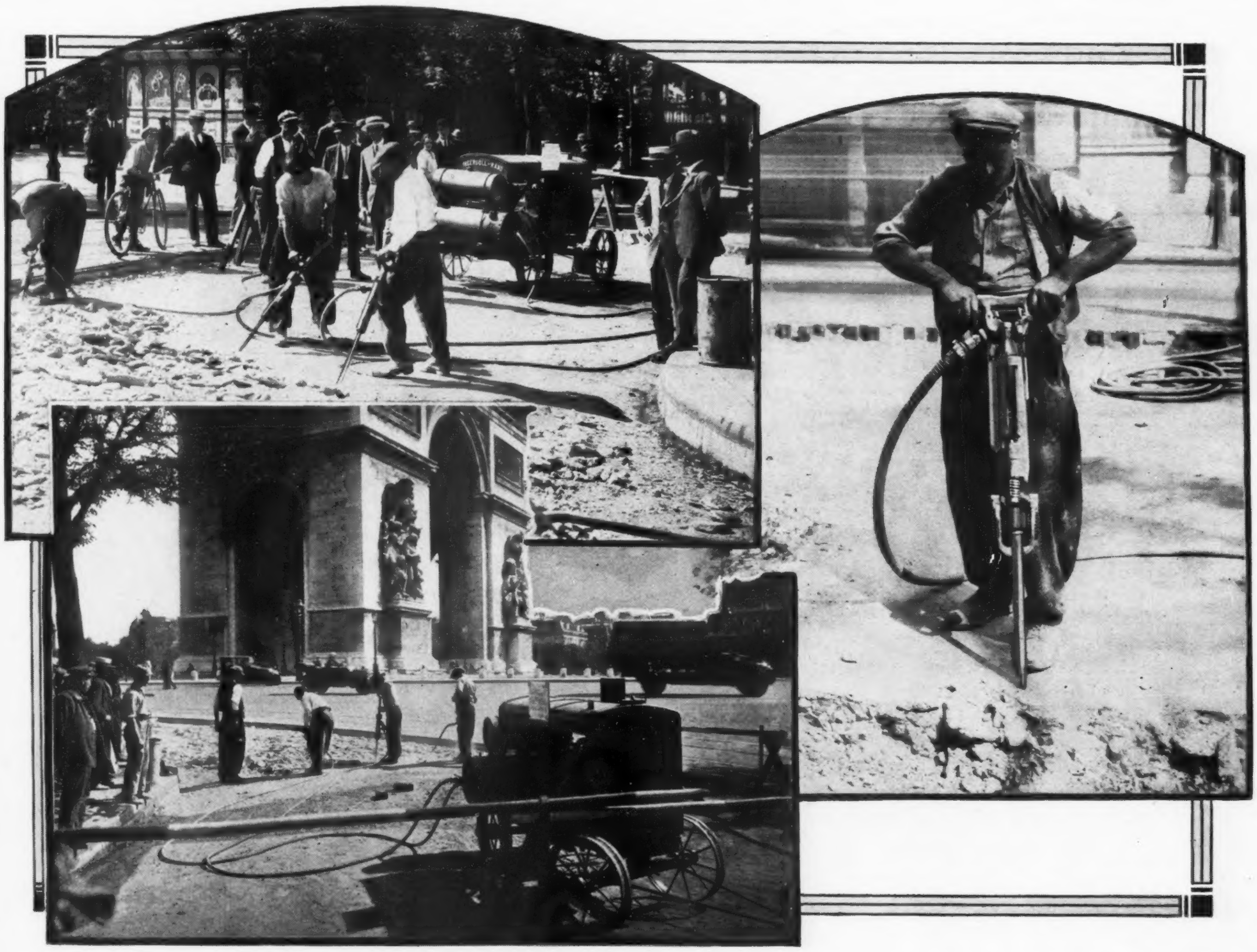
IN AN elaborate paper, read in London before the Newcomen Society, upon an interesting detail of the theorizing of Leonardo da Vinci on matters relating to engineering, attention was called to the difficulty of deciphering his manuscript on account of the peculiarity of his writing. The following particulars were noted: he wrote from right to left after the fashion of the Semitic group of languages; his writing was of the kind known as mirrored or reversed, such as would be produced by looking at normal script through a mirror; he employed an elaborate scheme of abbreviation; and he omitted the use of punctuation.

FREEZING BUTTERFLIES

A NOVEL and interesting experiment is in operation at the London Zoölogical Garden, although it may be said to have gone beyond the experimental stage. A collection of rare and beautiful butterflies is being kept in a dormant state in low-temperature storage to prevent their hibernation at times when the public may want to examine them. They are taken from storage, as they are wanted, and placed in a case filled with flowers sprayed with honey. Under the glow of a powerful "pointer" light the insects assume their normal activity; and a continuous display is thus made possible when visitors are admitted. But who would want to be one of the butterflies?

IMPROVEMENTS IN SOUTHERN COTTON MILLS

COTTON mills are rising with great rapidity in the Southern States; and they represent the very latest thing in perfection of design and arrangement. In the new Stark mills, now being erected at Hogansville, Ga., the central air-conditioning apparatus is located at the top of the building, directly over the spinning room, instead of in the basement, as has been the practice. The new disposition effects a considerable saving in construction cost, because the large ducts run a shorter distance, and the basement is also improved in consequence for other service.



Portable air compressor and pneumatic paving breakers helping in the repair of the highway close to the Arch of Triumph in the heart of Paris. The Parisian authorities are fully alive to the time and the labor that can be saved by the adoption of these American roadbuilding facilities, and it is likely that outfits of this sort will soon be as familiar in Europe as they now are in the United States.

Monel metal is a natural alloy composed of 67 per cent. nickel, 28 per cent. copper, and 5 per cent. of other elements. In appearance it resembles nickel; in tensile strength it is comparable with steel; and its resistance to corrosion is very high. This latter quality has suggested its employment for the gauze in safety lamps; and tests conducted by the Bureau of Mines show it to be a very satisfactory material for the purpose.

An automobile factory at Lingotto, Italy, has upon its roof, over 100 feet above the ground, a testing track which is 3,810 feet or nearly ¾ mile around. It is used for experimental purposes and for testing the finished cars. The track, which surrounds 4 open courts, is 75 feet wide, and the curves are banked 20 feet high so that high speeds are possible. Supplies of gasoline and oil are always at hand, and are pumped from underground tanks.

During the last two years, 14,000 tons of German ammunition of a highly dangerous character, which was recovered from the devastated regions and the forward areas of the north of France, has been dumped into the sea about 2½ miles from the Port of Dunkirk. Not one unfortunate incident or accident occurred either in the dumping operations or in the transportation—a record that is considered unique.

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EDITORIALS

AIRPLANE COMES OF AGE THIS YEAR

ON THE seventeenth of December of the present year the airplane will have passed from adolescence to maturity, using the span by which humankind attains to the dignity of manhood. But, as a matter of fact, in those 21 years there has been given birth and brought to an amazing climax a fascinating engineering undertaking that has puzzled the technical mind for quite 400 years—starting with that rare genius Leonardo da Vinci who visualized so many seemingly impossible things which have since become commonplace.

When ORVILLE WRIGHT soared aloft on December 17, 1903, and proved on a modest scale that a heavier-than-air machine could be sustained in flight, he and his brother blazed the way for a progress in aviation which probably neither then believed possible even in their wildest dreams. From that initial performance at Kitty Hawk until the airplane was able to fly from Fort Myer, Va., to near-by Alexandria and return was a matter of five years of hard work and the mastery of many difficulties. Indeed, the practical value of the airplane—its capacity to hold its own in the teeth of opposing winds and to mount aloft night or day—was not conclusively demonstrated until the urge of armed strife brought about astounding betterment in structural get-up and in propelling motors. Now, thanks to the lessons learned during those awful years, the flying machine has been made especially fit for peacetime service of great value and of tremendous potentialities.

The public at large is scarcely alive to the work being done by the Post Office Department in carrying mail by airplane over long distances and at speeds far beyond those attainable by the fastest of our railway trains; and it is inevitable that the same mediums will be used in the near future for the transportation of considerable quantities of certain sorts of express matter. Again, the flying machine is extensively employed today in passenger service; and the number of accidents is small compared with the work performed and the total distances covered.

The Aeronautical Chamber of Commerce recently issued a review of the achievements of American aviators during 1923, and we are authoritatively informed that the flying men of this country captured 33 world records in that twelvemonth. And now, plans are in the making for a flight around the world by members of the United States Army Air Service. Surely, this is a brilliant record of progress in aerial navigation, especially when we bear in mind that most of this advance has been effected in less than a decade. Well may we ask: What will the near future bring now that the flying machine has reached its majority and is in the full swing of a matured stride?

AMERICA'S DYE INDUSTRY FIRMLY ESTABLISHED

THE PEOPLE of this country may take pardonable pride in what has been achieved in less than ten years in creating a domestic dye industry capable not only of meeting well-nigh all America's needs but of assuming a formidable position in the markets of the world. To fully understand what has been accomplished in this brief span it is necessary to recall that there were in the United States in 1914 but seven small, struggling firms engaged in the making of dyes for textile purposes. At that time, the vast bulk of the dyestuffs used here was imported, and Germany had a dominating grip upon the business.

It is a matter of common and painful knowledge just what happened to us when the World War shut off our supplies of dyestuffs from Germany and we set about the making of them here—our home-produced dyes were of very poor quality, and the colors at first faded and ran. But our chemists persisted; special equipment essential to success was devised; and gradually we built up skilful plant personnels capable of doing everything the Teutons had done and, in some instances, going them one better. A fuller grasp of what this victory has meant can be had when it is realized that the dye industry is the twin sister of the art of fabricating high explosives and, therefore, intimately allied with the sinews of national defense.

The United States Tariff Commission has recently issued figures showing the growth of America's independence in this field of enterprise. It seems that the seven American firms engaged in the business in 1914 turned out a total of 6,619,729 pounds of dyestuffs, then valued at $2,470,096; while the sales of 87 domestic concerns making dyes in 1922 amounted to 69,107,105 pounds, worth $41,463,790. The average sale price of domestic dyes for 1922 was 60 cents per pound in contrast with 83 cents a pound in 1921 and $1.26 cents a pound in 1917. The year of the outbreak of the World War, we imported nearly 90 per cent. of all the dyestuffs used by us, and the imports at that time totalled 45,950,785 pounds. The imports in 1922 were only 6.5 per cent. of our tremendously increased consumption!

PASSE BUT INTERESTING

TO THE average mind the value of an egg is measurable in terms of freshness; and, when lacking that characteristic, we know how it may ruin a morning meal or wreck the peace of a whole day! Think, then, of the myriads of departed green grocers who will turn in their graves and of the hundreds of thousands of their living fellows who will stand aghast at the thought of offering eggs millions of years old to a guileless public; and yet this is exactly what was lately done in the very heart of modern sophistication—the City of Greater New York.

There comes a time in the history of any egg when its age ceases to taint it and its survival becomes provocative of scientific speculation. This change of attitude takes time—much of it in fact, and in the case of the eggs in question there has been a lapse of fully 10,000,000 years since they were laid. The Third Asiatic Expedition of the American Museum of Natural History unearthed a couple of dozen petrified dinosaur eggs some months ago in the Gobi Desert; and it is hoped by selling a number of them to obtain much-needed funds wherewith to carry on further investigations in that part of Mongolia. A few thousand dollars apiece is not much to ask for dinosaur eggs if thereby more secrets of the very remote past can be disclosed.

If those monster reptiles originated in the center of Asia and then migrated to what we now know as America, the savants tell us it is not improbable that man, too, had his beginning in the same cradle of animal life. Therefore, through the sale of a dozen dinosaur eggs, a day of amazing revelation may be hastened.

NO MORE DIAGNOSING

IT REALLY is time to stop all this constant rehearsing of symptoms: this diagnosing and prescribing for the promoting or, as some would have it, for the restoring of our national health. It is not consistent with our present industrial and commercial condition. We are not sick, and it is time we forgot that we have been sick. The simple fact is that we are too busy for any such nonsense, and we ought to drop it as we soon will have to, whether or no.

Whoever knew a man who was persistently counting his pulse; looking at his tongue; taking his temperature; keeping a daily record of his weight; and boring his friends with his stories without involuntarily realizing that he could not possibly be a well man? The complete automatic ignoring of the lugubrious is the last but most necessary assurance that we need of our established well-being. We may fail to recognize any actual return to

normal conditions, for the normal standards of the future may not be those of the past.

The everlasting optimist, who is the only true American, is confident that the momentum we are now acquiring must carry us far into a new normality, as yet undreamed of, in which all the nations must ultimately participate.

INCREASING THE RANGE OF AUDIBILITY

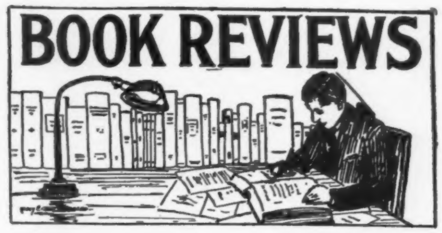
AT A TIME when many well-meaning persons, physicians, and inventors are railing against the nerve-wracking consequences of sustained noises, and are combining to find ways and means for their softening or suppression, it would seem superfluous and an effort in the wrong direction to render audible sounds to which the normally acute human ear is deaf. This is exactly what has been done, however, through the agency of an exceptionally supersensitive microphone devised by Dr. PHILLIPS THOMAS collaborating with one of America's great electrical manufacturing companies.

We are told that the new microphone will do for the ear what the microscope has already done for the human eye; and certain entomologists have expressed a lively interest in the instrument because by it they expect to hear and to interpret insect sounds at the mating seasons which have hitherto been beyond detection. Possibly, the traditional bug slumbering snugly in the rug may now be found to snore loudly; and the flea in the ear may be even more vocal than the well-known bee in the bonnet. This opens up a tremendous field of usefulness in a year filled with presidential aspirations.

On December 12, last, Longfellow J. Daft, at the age of 64, died at his home in Edmonds, Wash. Mr. Daft was born in Huntington, W. Va., where he managed the coal department of the Ingersoll-Rand Company of New York City for twenty years. After that he represented the same company in Europe for a matter of ten years. Owing to ill health, Mr. Daft resigned the position that he had filled so well and moved to Seattle, where, for thirteen years, he was engaged in the coal business. Five years ago Mr. Daft retired from active work. He is survived by his widow, Mrs. Nellie H. Daft, of Edmonds, and two sisters living in Huntington.

The third installment of the article describing work on the Big Creek Hydro-Electric Project does not, as was intended, appear in this issue, owing to the absence of the author from the job. At the earliest practicable moment Mr. Redinger will send in additional copy, and it will be printed as soon thereafter as possible. We regret this break in the presentation of the subject, because we are fully alive to the interest that the matter has aroused among our readers.

The removal of an old military bridge over Rock River, at Rockford, Ill., involved the demolition of 200 piers—dynamite, exploded under water, being the agency employed. The sticks of explosive, wrapped in cheap table oilcloth, were tied to the piers by a diver.



A TEXTBOOK OF ADVERTISEMENT WRITING AND DESIGNING, by B. C. Woodcock. A well-illustrated book of 184 pages, published by E. P. Dutton & Company, New York. Price, $5.00.

IN THIS volume, the author shows in a very graphic way how to collect and to classify the raw material for advertisements and how to build up this material—commencing with the smallest and least pretentious typesettings and working up to large and comprehensive illustrated displays. The purpose has been to provide a textbook for the use of teachers and lecturers on the subject of advertising; to enable young men and women to study advertising at home with the object of qualifying themselves to enter the profession of advertisement writing and designing; and to furnish a book of reference for those already in the profession that will give them an enormous variety of materials to draw upon.

The work is not so much a set of stereotyped rules as a compendium of suggestions from which new and independent lines of thought may be developed; and the ground covered is so wide that the book will be found suitable for use in preparing advertisements of every description and class.

ABSTRACT OF THE FOURTEENTH CENSUS OF THE UNITED STATES, 1920, compiled by the Bureau of Census, United States Department of Commerce. An informative book of 1,303 pages, for sale by the Superintendent of Documents, Government Printing Office, Washington, D. C. Price, cloth bound, $1.50.

THIS Government publication is a summary of the more important and significant statistics contained in the eleven volumes of the Fourteenth Census Report, and is designed to meet the requirements of those who desire the 1920 Census figures in convenient form for ready reference. The abstract is divided into seven parts, covering population, occupations, agriculture, irrigation, drainage, manufactures, and mines and quarries, and gives the statistics for the United States as a whole, by states, and by groups of states.

PRACTICAL PSYCHOLOGY, by Burt Byron Farnsworth. A book of 308 pages, published by C. W. Clark Company, New York. Price, $3.00.

THIS BOOK has been written by Mr. Farnsworth upon request, and is a compilation of a series of lectures delivered by him upon the subject of psychology. It is especially intended for men and women in the industries and in professions, and brings out in a popular manner just "how to put Psychology into harness and how to make it work."

Psychology is neither a deep mystery nor a mass of complex theories, but is something that every normal person can grasp and make use of; and the study of the subject, as presented by the author, should make clear to the reader the fundamental principles of mental activity and also indicate how these principles may be applied to personal development and to the daily task.

THE JOURNAL OF THE IRON AND STEEL INSTITUTE, Vol. CVII, edited by George C. Lloyd, Secretary, and published by Spon & Chamberlain, New York.

THE PRESENT volume covers the Annual Meeting of the Institute held in London, May, 1923, and contains 22 papers with the discussions and correspondence thereon. It is not possible here to refer to all the papers treated, but among the topics dealt with are: *British Steelworks Gas-Producer Practice,* by Fred Clements; *Some Characteristics of Moulding Sands and Their Graphical Representation,* by J. E. Fletcher; *A Contribution to the Study of Hardness,* by Prof. C. A. Edwards and Charles R. Austin; *The Potential Energy of Cold-Worked Steel,* by Thomas F. Russell; and *The Structural Constitution of Iron-Carbon-Silicon Alloys,* by Kôtarô Honda and Takejiro Murakami. In addition to the papers, the Journal devotes 148 pages to notes on the general progress of the iron and steel industries at home and abroad.

Trade Standards Adopted by The Compressed Air Society is the title of a 39-page pamphlet that has just been published and which embodies the results of extended study and research on the part of executives and engineers associated with that organization. The booklet includes, among other things, brief chapters on nomenclature and terminology, compressor speeds, standard capacities and pressures, installation and care of air compressors, lubrication, and cleaning air-receiver piping. Copies may be obtained by addressing the Secretary of The Compressed Air Society, 50 Church Street, New York, N. Y.

The United States Bureau of Mines has announced the following list of new publications:

BULLETIN 212. Analytical methods for certain metals, including cerium, thorium, molybdenum, tungsten, radium, uranium, vanadium, titanium, and zirconium, by R. B. Moore, S. C. Lind, J. W. Marden, J. P. Bonardi, C. W. Davis, and J. E. Conley. 1923. 325 pp., 1 pl., 4 figs. 40 cents. An exhaustive treatise. Discusses all methods that have been recommended and gives approved methods in detail.

BULLETIN 219. Explosives, their materials, constitution, and analysis, by C. A. Taylor and W. H. Rinkenbach. 1923. 188 pp. 20 cents. Discusses constituents of explosives and gives approved methods for their determination. Contains data on thermochemistry of explosives.

Application for these bulletins should be made to the Superintendent of Documents, Government Printing Office, Washington, D. C.

What must have been an extremely interesting illustrated lecture was given recently in London, the subject being *Underground London,* with the following enumeration of topics: hidden rivers, springs, spas and wells, sewers, subways, steam railways, electric tube railways, early and modern Roman baths, caves, remains, bakehouses, restaurants, wine vaults, mains and pipes, obstructions, etc. Perhaps no other city could make as big a showing. Underground construction was the special interest underlying the matter presented; but pneumatic dispatch tubes and conduits for telephone, telegraph, and other electric transmissions seem to have escaped mention.

BUILDING MATERIALS FOR BOULDER CANYON DAM

THE Bureau of Standards has designed an apparatus, now in process of construction, for making permeability tests on various types of building stone. This apparatus will take care of pressures up to 400 pounds per square inch and, with slight modification, can be used for higher pressures when desired. The rate of percolation, when testing such dense stones as granite and marble, is so low that rather high pressures will probably be necessary.

This work has been undertaken in connection with the study of stone for use on the Boulder Canyon Reclamation Project, which will involve the construction of a very high dam. However, the determination of permeability is of interest in connection with the general study of the physical properties of stone, and it is proposed to cover several varieties in the investigation.

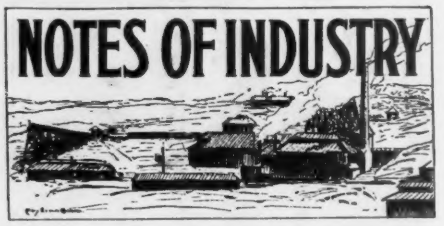
Another line of research now under way has to do with the testing of samples of sand, gravel, and rocks from the vicinity of Boulder Canyon, on the Colorado River, western Arizona. The samples are of materials now under consideration as possible sources of aggregate for the concrete work on the dam. The testing is of particular interest, as problems are involved which do not ordinarily arise in the eastern part of the country. For example, the rocks from the Boulder Canyon region cannot be accepted as suitable aggregates merely because they meet the prescribed physical tests. What is more important is an examination for constituent minerals that may be subject to comparatively rapid alteration and disintegration. This phase of the work is very largely in the hands of the Geological Survey, but certain experimental "soundness" tests for durability of these aggregates are being conducted by the Bureau of Standards.

GAS HOLDER OF ENORMOUS CAPACITY

A GAS HOLDER has recently been erected at Belfast, Ireland, possessing novel features of interest. It is 250 feet in diameter and about 140 feet high when fully charged, giving it a record capacity of 7,000,000 cubic feet. There are four lifts, but the usual surrounding, vertical framework is entirely dispensed with.

Each lift has upon the outside a number of projecting strips placed at an angle of about 45 degrees. These strips travel between guides that tend to give each lift a rotary movement as it rises, thus securing a uniform lift all around and always keeping every member level. The alternate lifts rotate in opposite directions. The cups and dips are 30 inches deep, giving a minimum seal of 10 inches when the holder is fully extended. In the erection, pneumatic riveting was employed throughout with oil-engine-driven compressors.

To catch tuna and swordfish on the west coast, kites are being used for the purpose of carrying the hooks and bait far away from the boats. After the kites are sent up the fishing line is attached to the kite string, and this drags the line along over the water. When a fish bites, the fisherman reels in close enough for a companion to strike with a harpoon.



A little more than 25 years ago there were four automobiles in the United States, and one of these was in a circus. Today, the registrations are above 12,000,000, with no sign of satisfying everybody.

It is said that the Alaska-Juneau mine—the last of the great Alaskan gold producers—crushed and treated 198,000 tons of rock in November, 1923, at a profit of but six cents a ton. Only excellent management and very economical operation permitted even that small profit.

The yearly output of telephone cables by the Western Electric Company, the manufacturing branch of the Bell system, is 6,000 miles. These cables contain 2,436,000 miles of copper wire.

A non-magnetic cast iron is being produced by Ferranti, Ltd., of Holliwood, Lancashire, England. The magnetic permeability and the machining qualities of the metal are said to be substantially the same as those of brass, while the cost is much less.

The Southern Pacific Railroad of Mexico is to commence the erection of an ice plant at Empalme, Sonora, at a cost of $250,000. It will have a capacity of 50 tons per day; and the ice is to be used for refrigerator cars running from the west coast of Mexico, through Tucson, to eastern markets in the United States.

It all depends upon where you stand when you look at it. The following frank statement of *Manufacturers Record,* Baltimore, is certainly interesting and can scarcely be questioned. By reason, it says, of the destructive work of the boll weevil in cutting short the yield, this year's cotton crop will probably bring in the neighborhood of $1,600,000,000; whereas, if we had no weevil, the acreage in cotton might have produced a much larger crop which would have sold for at least $600,000,000 less than the smaller crop.

The government inspector of Madras fisheries is reported to have located no less than twenty miles of pearl oyster beds in the Gulf of Manar between Ceylon and the southernmost coast of India. The beds are still young; but in 1926 extensive operations are looked for.

The world's merchant marine by June 30, 1923, had increased 1,128,000 gross tons over that recorded for the same date a year before. In this connection it is interesting to note that while 63 per cent. of the increase for the last twelvemonth was in the German fleet, which was augmented from 1,783,000 gross tons in 1922 to 2,496,000 gross tons in 1923, it is still but 52 per cent. of its pre-war strength.

The steam whistle of the Libby Island, Me., fog-signal station is being replaced by a compressed air diaphone. This is in line with the policy of the United States Bureau of Lighthouses that calls for the gradual supplanting of the older order of fog signal by the newer and more efficient pneumatic system.

A barrage to dam the Oued Kebir near Zaghouan, Tunisia, is being constructed, and this undertaking goes to show how history repeats itself. The dam is practically a modern counterpart of the works built by the Romans about 2,000 years ago to supply the ancient City of Carthage with water. Tunis now receives its water from the source that once supplied Carthage; and the main object of the dam, which is to be finished in about eighteen months, is to give the capital an abundance of potable water.

Iceland is using refrigeration this year for the first time in the exportation of meats. Heretofore, the fairly large quantities of mutton destined for Great Britain were slightly salted and then barreled for shipment.

Based upon the 1922 returns recently furnished by the National Canners' Association, the 80-odd milk condensaries of this country produced 4,784,000 cases of condensed and 19,088,000 cases of evaporated milk, or 200,928,000 and 916,224,000 pounds, respectively. This is a slight decrease as compared with the previous year's pack.

The maximum difference in elevation of land in the United States is 14,777 feet, according to the United States Department of the Interior. Mount Whitney, the highest point, is 14,501 feet above sea level, and a point in Death Valley is 276 feet below sea level. These two places are both in California and are less than 90 miles apart. This difference is small, however, as compared with that in Asia. Mount Everest rises 29,002 feet above sea level, whereas the shores of the Dead Sea are 1,290 feet below sea level—a total difference of 30,292 feet. In Europe the difference between the highest and the lowest land points is about 15,868 feet.

According to *Commerce Reports,* there is more activity in the sales of Chilean nitrate. Shipments from January 1 to November 15, 1923, amounted to 1,794,380 long tons as against 882,000 long tons produced in the same period in 1922. In other words, the output was doubled.

All the better-equipped caravans that trek out of Aden across the desert are provided with vacuum bottles—a modern convenience that makes the thirsty traveler independent of the ofttimes widely scattered oases.

About 20,000,000 gallons of ice cream was sold in England during the summer of 1923, or five times more than the quantity consumed in the banner year of 1919. The introduction of American methods of manufacture and the realization that ice cream is nourishing and digestible have brought about the increase in the business.